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TECHNICAL DEPARTMENT

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May
1931

Construction Methods

To— ~~MR. BEATTY~~ S-16
~~MR. KUEHN~~ 5/14
Return to— Filing Dept.

Client DODGE TRUCKS
Publ'n CONSTRUCTION METHODS
Date of Issue MAY 1931 Page No. 89
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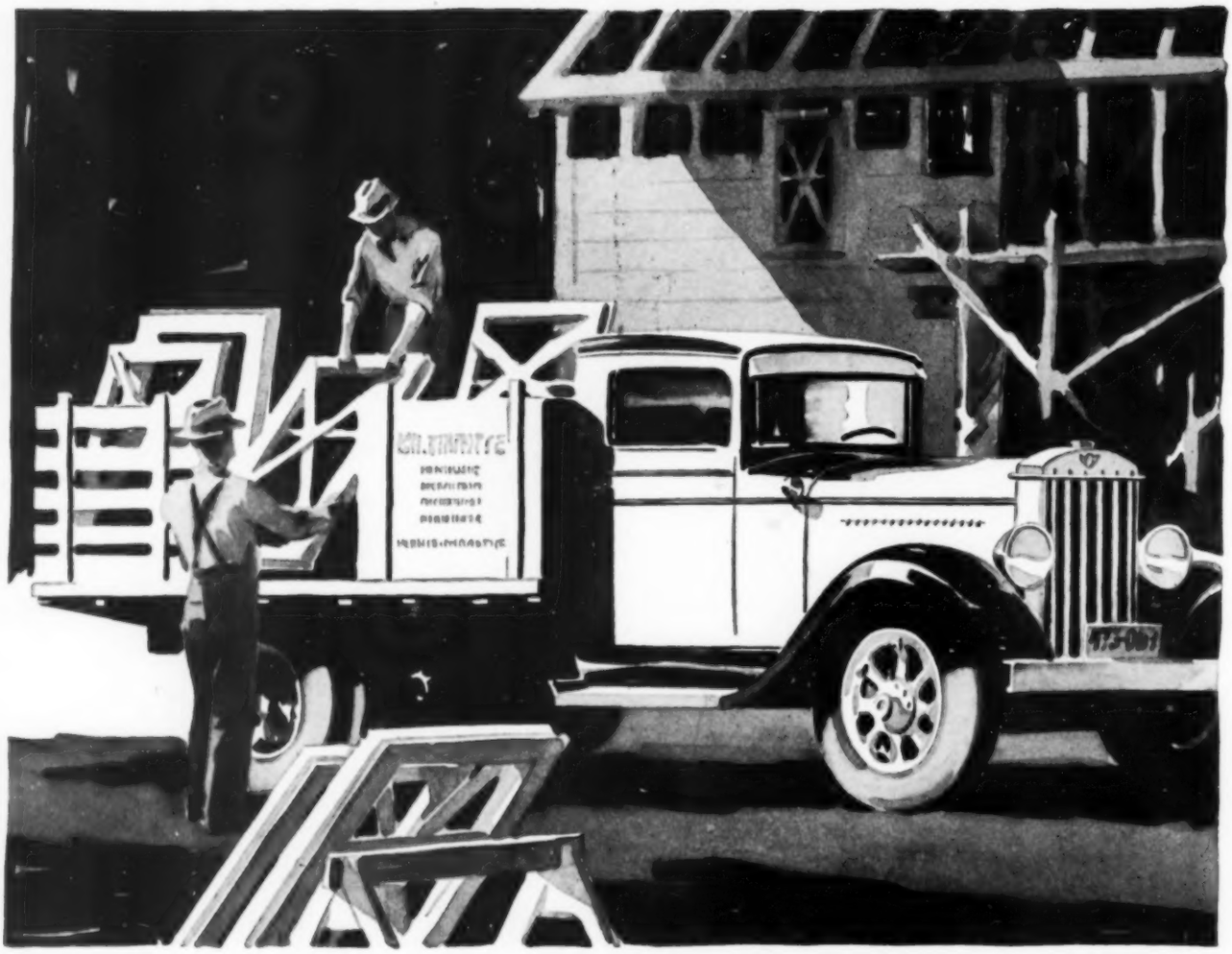
Form 314 Filing Dept.
ADVERTISERS INCORPORATED

Opening Up Highway to
HOOVER DAMSITE
Across Nevada Desert

FILING DEPT. 10
ADVERTISERS INC.

A MONTHLY REVIEW OF FI



18 Years of Reliable Service Behind— Prolonged Years of Even Finer Service Ahead

Commercial transportation standards are invariably set by Reo.

Eighteen years ago, Reo first introduced light, more-power-for-weight, speedier, safer, lower-cost SPEED WAGONS, and has maintained engineering dominance ever since.

Hundreds of thousands of REO SPEED WAGONS and TRUCKS have been placed in operation in 64 countries, hauling structural steel down congested Broadway, bringing Brazilian coffee to coastal shipping ports, or patrolling the vast desert stretches along the Great Wall of China!

The same story of day-in-day-out reliability and astounding infrequency of repair has travelled the world around, and has won universal acceptance for REO products.

In face of these irrefutable results, the REO is deserving of a lasting place in your system of transportation service.

REO MOTOR CAR COMPANY, LANSING, MICH.

TECHNOLOGY DEPT.

SPEED WAGONS REO AND TRUCKS

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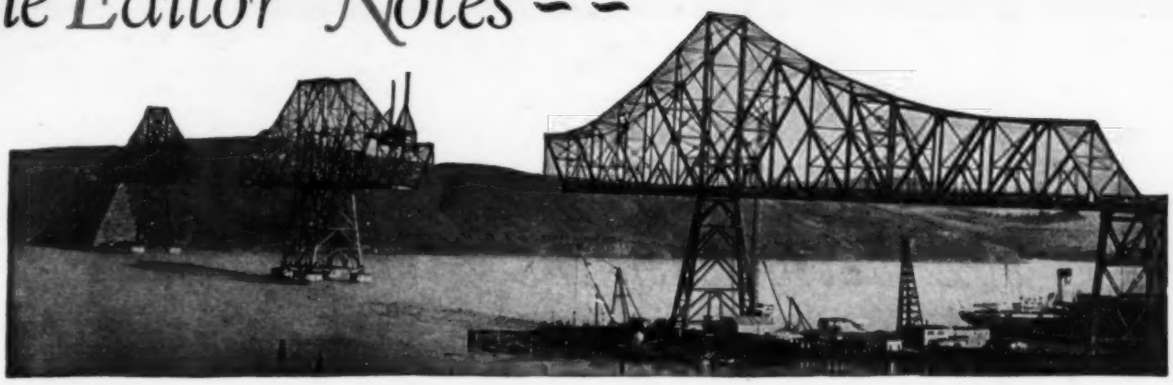
The Editor Notes - -



Bigger Profits From Better Truck Haulage

POTENTIAL profits on road-building contracts are often pared down or entirely wiped out by inefficient operation of the motor trucks which haul cement and concrete aggregates from the material yard to the paving mixer. That preventable losses chargeable to hauling equipment assume large proportions on the average job is evident from the analysis of truck operation on more than 100 paving projects, as reported on p. 50 by Andrew P. Anderson of the U. S. Bureau of Public Roads. For the road builder the meat of the conclusions is found in the statement that 17 per cent of the time during which the construction crew is out on the road ready to work is lost because of insufficient supply and faulty operation of hauling equipment.

Here is a challenge for the paving contractor. Where do these time losses occur? How can they be prevented?

Successful concrete paving means effective coordination of a train of interdependent operations, all built around the mixer as the pacemaker. Operating on a definite time cycle, governed by the specified mixing period, the paver can not be speeded up to compensate for operating delays. Time lost at the mixer is time lost irretrievably. Hence the importance of regular and sufficient truck deliveries of aggregates and cement to insure uninterrupted mixer output—the bottleneck controlling paving progress.

Time Lost at Material Yard

Trucking time losses do not all occur en route to the mixer. Individually short, but bulking large in the aggregate, delays of one sort or another at the material yard, often due to poor layout, are a big factor in reducing the efficiency of hauling equipment. Typical of such time losses are those occasioned by wasteful maneuvering of trucks at the batchers, where the driver must back up under the bins instead of passing under them along a through driveway. Other preventable delays occur in loading the cement, turning the truck just before it reaches the mixer, backing up to the loading skip, hoisting the truck body, dumping and returning, empty, to the material yard. By timing each of these operations with a stop watch, as was done by representatives of the Bureau of Public Roads, it is possible to discover exactly where losses occur and how they can be eliminated. The results show that the saving of only a few seconds in several of the operations forming the train are well worth while.

Determining Number of Trucking Units

A valuable feature of Mr. Anderson's report is his method of determining the proper number of trucking units for various conditions of truck speed and length of haul. He gives some useful data, too, on the comparative advantages of single and multiple-batch trucks and shows how the prevalent practice of subletting the haulage, instead of having it directly under the control of the paving contractor, operates to hinder efficient operation of the paving plant.

Every road builder who is striving for maximum production from his plant will do well to make a careful study of this excellent report on truck operation. It is replete with suggestions that alert contractors can capitalize to yield increased profits on their own work.

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

Editorial Staff

VINCENT B. SMITH NELLE FITZGERALD

J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, *Publishing Director*

A McGraw-Hill Publication

Tenth Avenue at 36th Street, New York

Compressors and Drills for Hoover Dam

ONE indication of what the Hoover dam means in terms of machinery necessary for its construction is conveyed by the order for air compressor and rock-drilling equipment placed last month by Six Companies, Inc., contractor on the $49,000,000 Colorado River project, with the Ingersoll-Rand Co. For supplying air to drive the four 57-ft. diameter, 4,000-ft. long, diversion and penstock tunnels and to excavate the main dam foundations and spillways, there is being installed a stationary, electrically-driven compressor plant with a combined output of 25,000 cu.ft. per minute, believed to be the largest ever installed for furnishing high-pressure air for rock tunneling. In addition, portable compressors will furnish air for scaling down the canyon walls and for other operations. When it is realized that the contract estimates for the Hoover dam and power house call for a total of 5,800,000 cu.yd. of rock excavation and about 15,000 miles of drill holes the need for a compressor installation of record-breaking size is apparent.

Levee Building Records

In these days of large output by construction machinery there is nothing very permanent about a "record" performance. A case in point is the monthly yardage of 231,000 reported in the December issue of *Construction Methods* (p. 50) for the new tower-cableway machine of Clarke Bros. Construction Co., used in the Mississippi valley to build levees for the Bird's Point-New Madrid floodway. The foregoing imposing yardage, we are informed, has been exceeded by one of the Government-owned tower machines at Gunnison, Miss., in charge of W. J. Mallett, foreman. This machine, one of the old type with raised tower, excavated and placed 280,142 cu.yd. of levee last September.

To Add to Each the Weight of All

A FEW weeks ago *Printer's Ink*, a weekly journal for advertising men, gave three rousing editorial cheers because five manufacturers of electrical refrigerators had run their advertisements on five consecutive pages in a single issue of the *Saturday Evening Post*.

The editor thought it was an excellent idea for these manufacturers to step, so to speak, "into a single room and deliver their sales talks in direct competition with each other." He hailed it as "an interesting indication of a new spirit that has invaded selling during the last few years."

New, perhaps, in the realm of refrigerators, tooth-brushes and fountain pens. But certainly not new in the field of business and industrial publishing.

For every industrial journal such as *Construction Methods* is a room into which the editors gather periodically a selected group of representative men who carry on the work of that particular industry. They meet to exchange ideas and experiences that have to do with the conduct of their every-day work.

And into that room step also the representative manufacturers of the materials and equipment needed by those men to do that work; there they "deliver their sales talks in direct competition with each other."

And wise construction men everywhere have learned the value of coming regularly to hear these talks as given each month in the "*Construction Methods* Room." They know that this is a most convenient and economical means whereby to keep in touch with what is new and valuable in methods, materials and equipment—all so necessary to their work.

Wise manufacturers, too, are glad to "step into this room" each month to tell their stories to this active and interested group of buyers, thoroughly aware that the effect of each such story is greatly increased by the cumulative influence of all.

Willard Chevalier

Publishing Director

McGRAW-HILL PUBLISHING COMPANY, INC., TENTH AVENUE AT 36TH STREET, NEW YORK, N. Y.

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Marietta Contracting Company
111 Third Street
Marietta, Ohio

March 16, 1931.

The Philip Carey Company,
6th & Broadway,
Cincinnati, Ohio.

Gentlemen:

Attn: Mr. W. S. Hollsender

This is to advise you that the West Fork Intercepter Sewer has now been completed. We take this occasion to compliment your Company and the Cincinnati Builders Supply Company on the excellent way in which you handled our orders for Expansion Joint used in this work.

As you know, this sewer is approximately 12,000 feet in length requiring about 70,000 lineal feet of Expansion Joint, a good part of which was special shapes, all of which was supplied as per requirements necessitating no delay at any time.

Very truly yours,
MARIETTA CONTRACTING COMPANY

70,000 feet of Carey Elastite Expansion Joint

"No delay at any time"

Here is another outstanding example of concrete construction — an interceptor sewer 12,000 feet long. Although the Expansion Joint had to be cut to special size, Carey Elastite Joint was delivered as required and on short notice.

Important concrete construction requiring Expansion Joint is almost always protected by Carey Elastite Joint, because the quality of the material and the certainty of its prompt delivery have been proved by 20 years of experience.

A nation-wide organization of distributors, carrying large stocks, insures that any order for standard or special sizes can be delivered on the job in the shortest possible time.

Write for 1931 Price List and Trade Discounts.

THE PHILIP CAREY COMPANY ✖ Lockland, Cincinnati, Ohio
Branches in Principal Cities

BUILT-UP ROOFS
ASPHALT PRODUCTS
ELASTITE EXPANSION JOINT
WATERPROOFINGS
ROOF PAINTS

Carey PRODUCTS

HEAT INSULATIONS
ASBESTOS MATERIALS
CAREYSTONE CORRUGATED SIDING
ASFALTSLATE SHINGLES
BUILDING PAPERS

508

Carrying motor-mixed concrete will soon wreck a chassis not designed for that particular work. Fleets of Model C Autocars that have carried thousands of yards of concrete mixed in transit and have stood up nobly, attest the fact that Autocar Model C is precision-built for this work. Tidewater Stone and Supply Company, Hackensack, N. J., have used Autocars for nine years. Ask them their opinion of these great trucks.

A heavy-duty, fast-stepping, solidly-built motor truck is essential to the economical transportation of concrete pipe sections. To do this work as it should be done, New England Concrete Pipe Corp., Boston and Newton, Mass., use this Model TFB Autocar, precision-built to the highest standards in the industry, powered with the great Autocar Blue Streak Six, and destined for many years of dependable service.

AUTOCAR TRUCKS

PRECISION BUILT

THE AUTOCAR COMPANY, *Ardmore, Pa.*

As raw material or manufactured product, concrete travels by Autocar

How well the contracting industry appreciates the diversity of specialized chasses in the Autocar line of trucks and tractors! What a satisfaction it is to know, when you have discovered the basic superiority of precision-built Autocars, that you can standardize on Autocars and still have a fleet of specialized hauling units!

Concrete ready to pour, concrete mixed in transit, concrete as manufactured pipe, and concrete aggregates can each be transported most economically by using the chassis designed specifically for that type of hauling.

You will find just such chasses in the Autocar line. Buy them with the satisfaction of knowing that you are investing your money where it will give you the greatest returns.

THIS IS PAGE 5

The close-quarter independent crowd

the crowd that wastes no power!

HERE is a crowd that for the first time combines independent reach with the delivery of the full power of the engine to the dipper lip.

The Northwest Close-Quarter Independent Crowd reaches out beyond the boom without juggling the hoist and crowd to spot the dipper. The waste of engine power present where crowding and hoisting is accomplished by separate mechanisms is elimiminated and the result is 25% more digging force at the dipper lip.

Never have such advantages in a crowding mechanism been offered the shovel user before. Think of it! Independent reach beyond the boom and 25% greater digging force.

Ask for complete details.

HANDLE 25% HARDER DIGGING

NORTHWEST ENGINEERING CO.

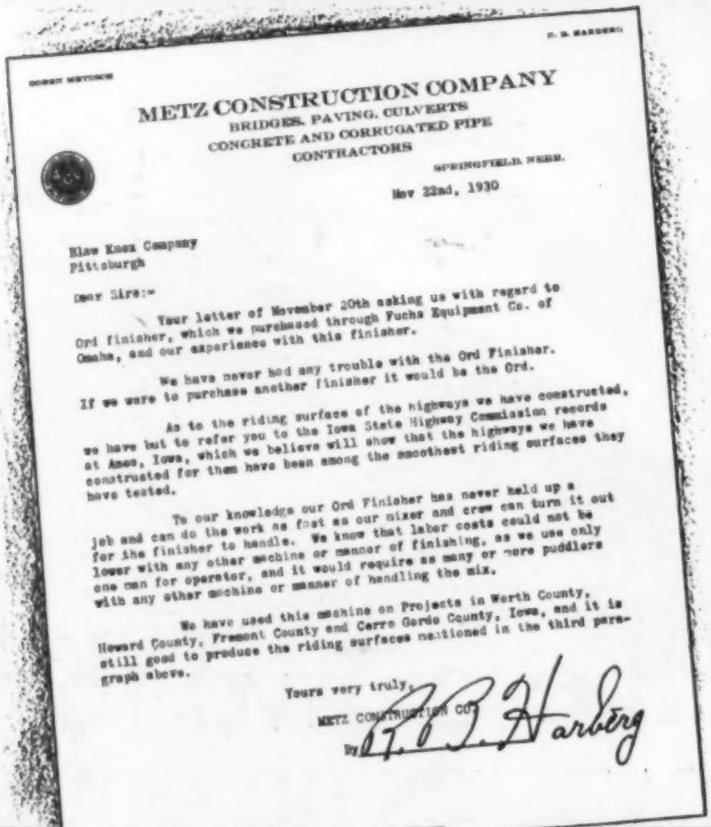
The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1728 Steger Bldg. 28 E. Jackson Blvd.

Chicago, Ill., U. S. A.

NORTHWEST

ROAD BUILDERS OK THE



METZ CONSTRUCTION COMPANY
BRIDGES, PAVING, CULVERTS
CONCRETE AND CORRUGATED PIPE
CONTRACTORS
SPRINGFIELD NEBR.

Nov 22nd, 1930

Blaw Knox Company
Pittsburgh

Dear Sirs:-

Your letter of November 20th asking us with regard to Ord finisher, which we purchased through Fuchs Equipment Co. of Omaha, and our experience with this finisher.

We have never had any trouble with the Ord Finisher. If we were to purchase another finisher it would be the Ord.

As to the riding surface of the highways we have constructed, we have but to refer you to the Iowa State Highway Commission records at Ames, Iowa, which we believe will show that the highways we have constructed for them have been among the smoothest riding surfaces they have tested.

To our knowledge our Ord Finisher has never held up a job and can do the work as fast as our mixer and crew can turn it out for the finisher to handle. We know that labor costs could not be lower with any other machine or manner of finishing, as we use only one man for operator, and it would require as many or more puddlers with any other machine or manner of handling the mix.

We have used this machine on Projects in Worth County, Howard County, Fremont County and Cerro Gordo County, Iowa, and it is still good to produce the riding surfaces mentioned in the third paragraph above.

Yours very truly,
METZ CONSTRUCTION CO.
By E. B. Harberg

Contractors who use the ORD Finishing Machine to build ribbon smooth concrete and asphalt roads, endorse its merits *definitely* and *conclusively.*

The ORD keeps ahead of the paver's maximum production. Its upkeep costs are extremely low. It is designed by engineers familiar with road building problems. It is the original *double screed* machine.

What contractors have to say about the ORD is your most valuable guide to the purchase of a finishing machine.

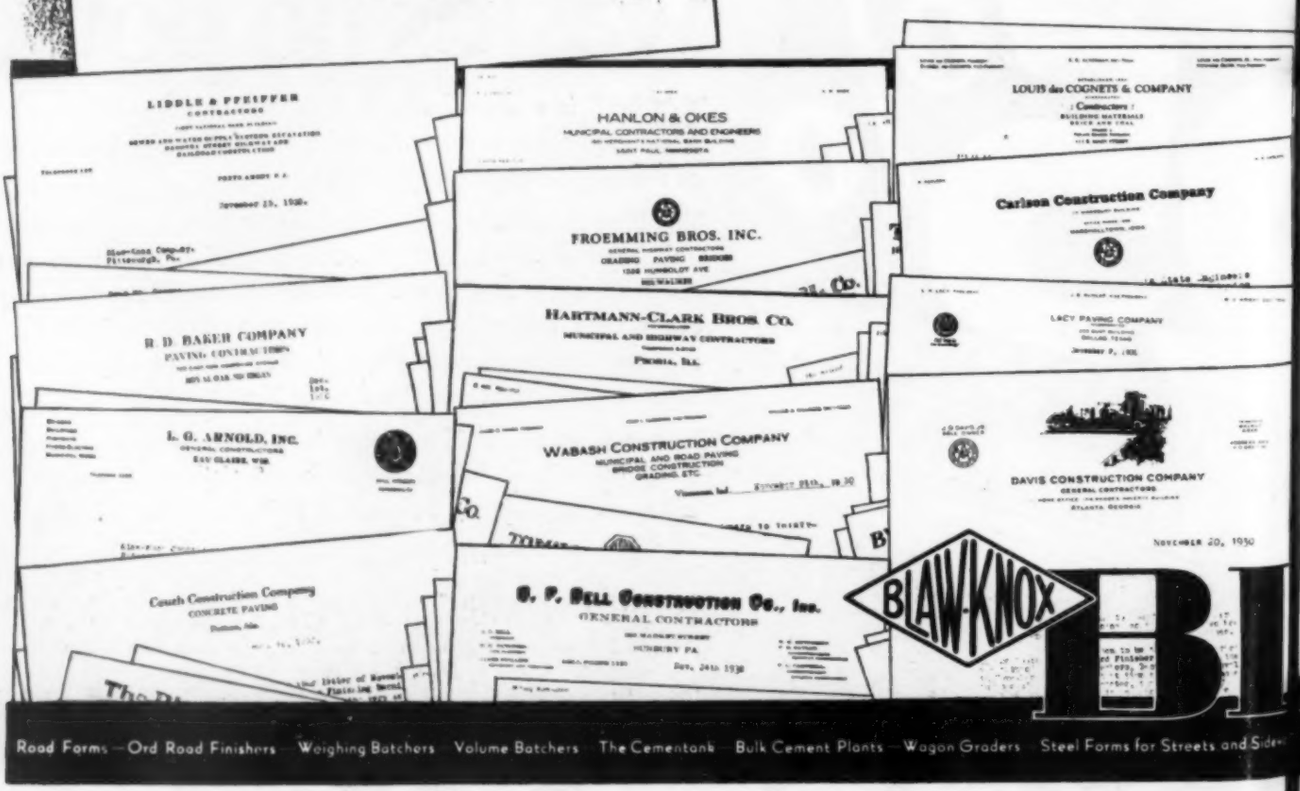
Write us and we will show you "Evidence from Ord Users."

BLAW-KNOX COMPANY
2086 Farmers Bank Bldg., Pittsburgh, Pa.

New York	Chicago	Detroit	Buffalo
Philadelphia	Birmingham	Cleveland	Baltimore

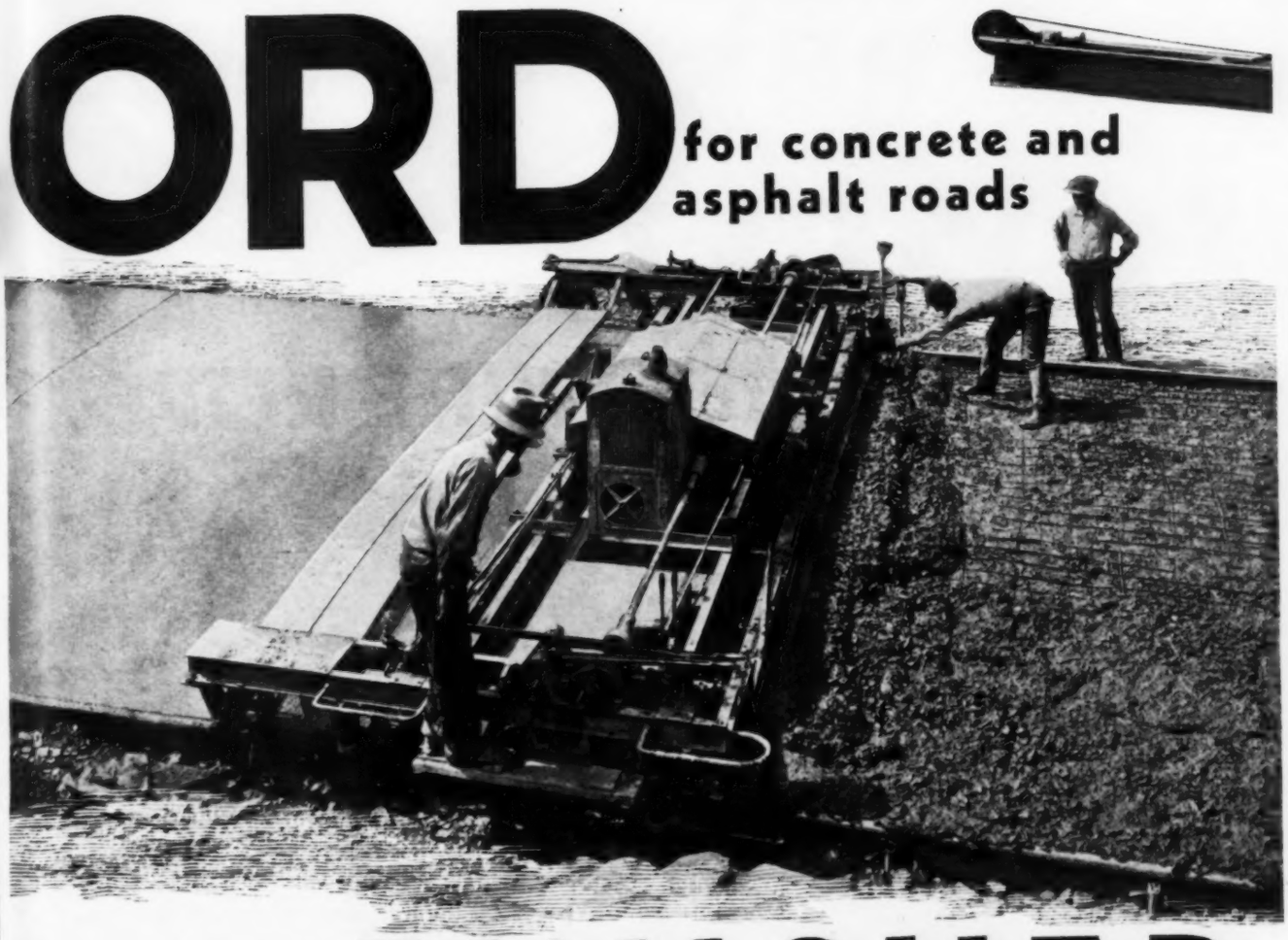
Export Division:
Blaw-Knox International Corporation, Canadian Pacific Bldg., New York

London, England, New Oxford House, Hart St., Holborn, W. C. I.—Paris, France, 1 Rue de Clichy—Milan, Italy, 6, via S. Agnese, 6—Dusseldorf, Germany, 17 Bismarckstrasse

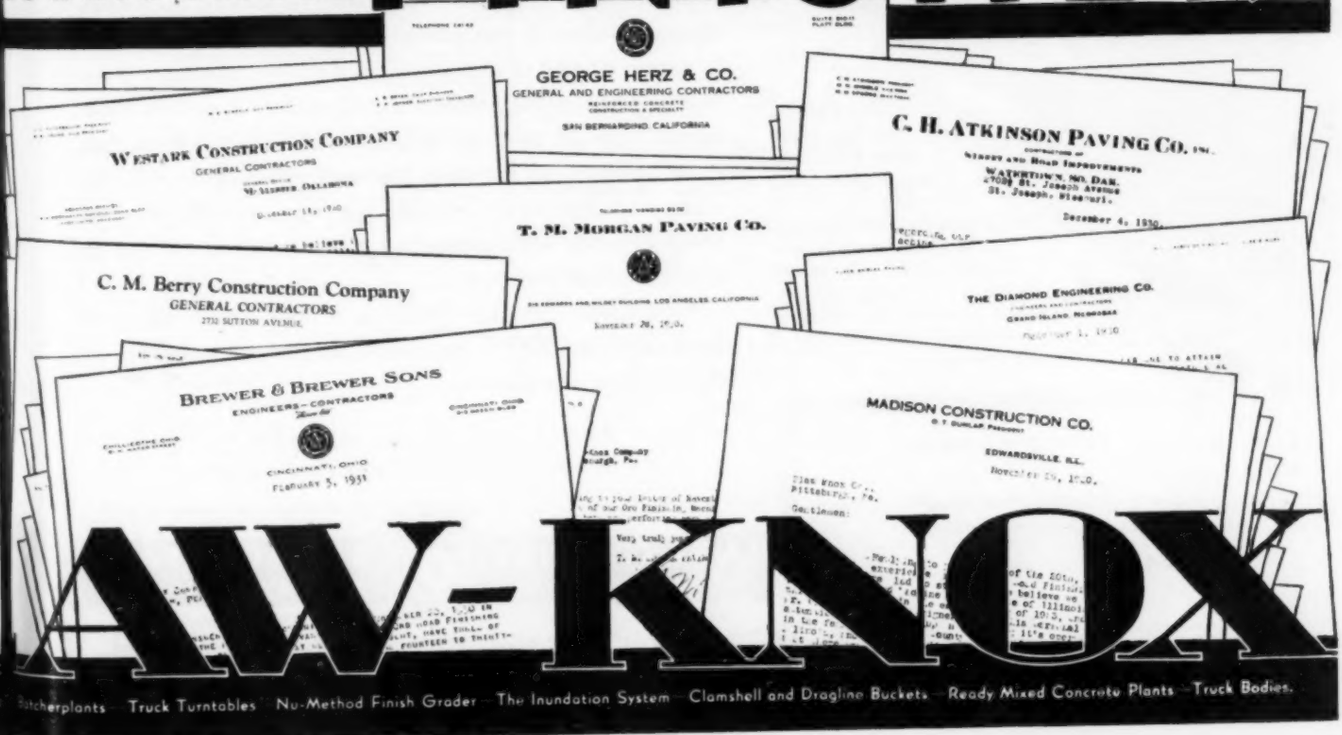


Road Forms — Ord Road Finishers — Weighing Batchers — Volume Batchers — The Cementank — Bulk Cement Plants — Wagon Graders — Steel Forms for Streets and Side

ORD for concrete and asphalt roads



the original double screed FINISHER



AW-KNOX

Butcherplants — Truck Turntables — Nu-Method Finish Grader — The Inundation System — Clamshell and Dragline Buckets — Ready Mixed Concrete Plants — Truck Bodies.

LAY-SET
PREFORMED WIRE ROPE

WIRE rope is always on the business end of every job. . . . And more and more contractors are specifying Lay-Set Preformed Wire Rope because Lay-Set gives longer service—cuts the frequency of shut-downs—installs faster—is easier to handle—is safer for the workmen—is easier to splice, etc., etc. . . . You see, ordinary wire rope has a great deal of internal stress amongst the component parts (wires and strands)—locked up within the rope when it was made. But Lay-Set is preformed (every wire and strand preshaped to the exact lay they must assume in the finished rope), and so Lay-Set rope is free from all pent-up tension or strain—the thing that is so detrimental to rope life and efficiency. All the wires and strands in Lay-Set are free to do their full share of work without wasting a part of their energy in internal stress and strain.

That's why Lay-Set Preformed Wire Rope will give from 30% to 300% increased service, depending on the working conditions.

Be sure your wire rope is Lay-Set Preformed. It is the economical rope to use.

Send for a sample of Lay-Set Preformed Wire Rope. It is free, and involves no obligation. When you get it—remove one strand from the piece, turn it end for end and replace it. Prove for yourself the preformed principle. It's not only interesting and instructive but it will make money for you.

HAZARD WIRE ROPE COMPANY,
Wilkes-Barre, Pa.

Send me a sample of Lay-Set Preformed Wire Rope —providing it places me under no obligation.

Name .....

Company .....

Address .....

City ..... State .....

HAZARD WIRE ROPE COMPANY
WILKES-BARRE, PENNSYLVANIA

New York Pittsburgh Chicago Denver
Ft. Worth Los Angeles San Francisco
Birmingham Philadelphia Tacoma

Announcing

the 37-B Shovel, Dragline, Clamshell, Crane

A Few of the Features

1. Speed, power and stability combined to make a 1¼-1½-yard shovel, dragline, clamshell or lifting crane with the operating speeds of a smaller machine.
2. Simplest possible convertibility.
3. Special extra long and wide mountings for soft ground dragline work.
4. All continuously running shafts mounted on ball bearings.
5. Reversing bevel gears for swinging and propelling, completely enclosed and running in oil . . . ball bearing mounted in one rugged casting that prevents spreading of bevel gears and insures permanent alignment.
6. Hoist clutches power set . . . all operating levers toggle in.
7. Transmission, swing reversing-gears, and all gears below deck, enclosed and running in oil.

Faster, lower-cost digging is at hand!

After long, thorough development, Bucyrus-Erie is ready with the 37-B, an all-new 1¼-1½-yard gas, Diesel or electric convertible.

Every part designed especially for this size. More modern, tested features than are available in any other make—Bucyrus-Erie ruggedness—just the right weight efficiently placed. The 37-B's advent means new possibilities of sustained high speed in hard digging. New chances to cut costs! New opportunities for profits!

Send for the complete story—you need it in your business!

BUCYRUS-ERIE COMPANY
South Milwaukee, Wisconsin

BUCYRUS ERIE

Representatives throughout the U. S. A. *Branch Offices:* Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Kansas City, Mo., Dallas, San Francisco. Offices and distributors throughout the world.

Bucyrus-Erie Company
South Milwaukee, Wis.
Please send me full facts on the new 37-B.

Name .....
Company .....
Address .....
City & State .....

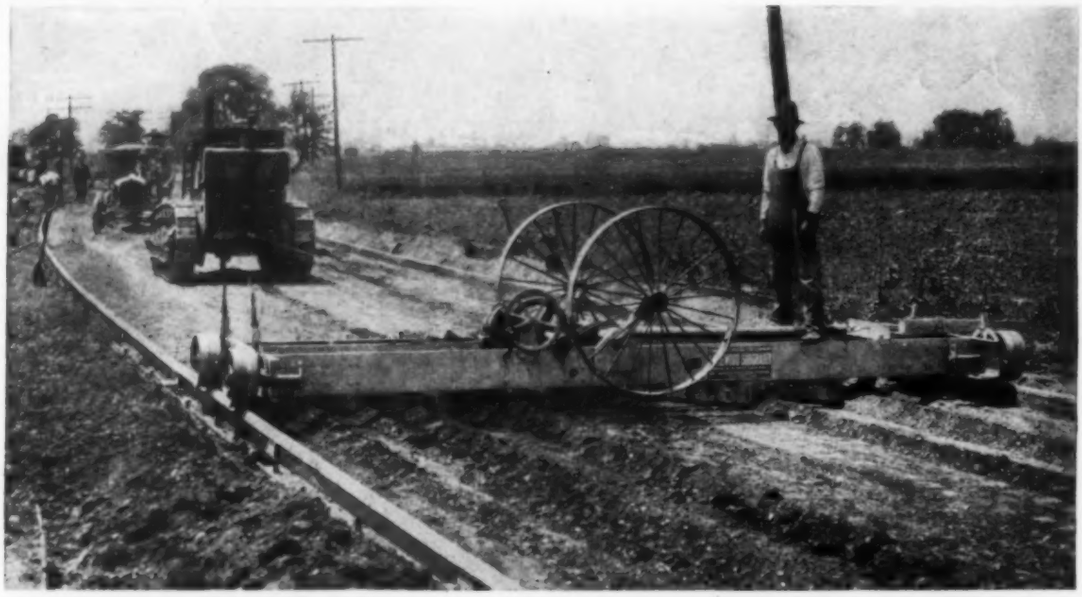
A-303-CM

1/2-yard
5/8
3/4
7/8
1
1-1/4
1-1/2
1-3/4
2
2-1/4
2-1/2
3
3-1/2
4
4-1/2
5 and up to 16 yards

Shovels
Drag-lines
Clam-shells
Lifting Cranes
Drag-shovels
Magnet Cranes
Tunnel Shovels
Dredges
Drag-line Buckets

Gaso-line
Diesel
Gas + Air
Electric
Steam
Diesel-Electric

You use it Only a Few Hours but it Saves You Money All Day



Rolls to side of road when not in use

IN one to three hours the Lakewood Subgrader will produce an accurate subgrade, sufficient for the entire day's run, leaving the roadway clear for truck hauling and the contractor insured against low grades and resulting losses in concrete.

Quickly adjustable in width and for any depth of cut and specified crown, this machine cuts a TRUE subgrade at a cost much LOWER than when done by less accurate methods. No other piece of paving equipment "BUYS ITSELF" so fast.

Low Cost, Accurate Grading Starts with the Lakewood Graderooter!

Replaces the rooter plow on today's jobs because it roots 48 inches wide at one time, is light enough for mule team, strong enough to use with 10-ton tractor. Works close up to forms.

Write or wire for CATALOG C

LAKEWOOD ROAD PUMPS
LAKEWOOD ROAD FORMS
LAKEWOOD FINISHING MACHINES
LAKEWOOD FLOAT. BRIDGES
LAKEWOOD BATCH BOXES . . . NARROW GAUGE CARS
LAKEWOOD SUB GRADERS GRADEROOTERS
LAKEWOOD STRAIGHT EDGES

THE LAKEWOOD ENGINEERING CO.

COLUMBUS, OHIO, U.S.A.

A STEADY PRODUCER THAT NEVER LOWERS ITS STANDARD

That's why the trusty Owen proves the BEST clamshell bucket investment . . .

Scooping up capacity loads every time, from the first to the last trip—getting more work done—costing less to do it—cleaning up the job in fewer hours. That's what you can expect when you put an Owen Bucket to work.

And after that job is done—ready for the next with no time out for repairs or re-conditioning. No lay-offs for breakdowns. Just a good, sturdy, dependable worker that treats every job alike—*in there* getting its usual "Mouthful at Every Bite"—often better than a mouthful.

That's the story, over and over again, when you buy an Owen. That's the kind of a steady worker it proves. Pays for its own hire, plus—soon after you put it on. A reliable producer—a sure money-saver and money-earner.

Write for facts that substantiate—also for the folder showing just how Owens are constructed.

THE OWEN BUCKET COMPANY
6023 Breakwater Ave., Cleveland, Ohio

A MOUTHFUL AT EVERY BITE

OWEN CLAMSHELL BUCKETS

Owen Buckets

Better Than a Crane . . . at One Third the Cost

● This Skid Crane Hoist with boom swinger can do almost everything that an expensive crawler mounted crane can do.

It drives piles—handles clam shell buckets—and can be used on small steel erection jobs.

And the cost is only about one-third to one-half that of the ordinary crane.

On the bridge jobs shown below, the rear or high speed drum of the hoist is used for pile driving.

The two front drums are used for handling the clam shell inside the cofferdam. Here slow digging is advisable in order not to tear up the cofferdam sheeting.

Because of the light weight, the Novo can work its way across streams on the falsework supported by the piles which it drives.

Brakes, friction lever clutch, throttle and all other controls are easily reached from the operator's platform. Line speed is 200 F. P. M. at 5500 lbs.

Send the coupon for complete facts and figures on jobs where these Novo Outfits are cutting contractors' costs. No obligation.

NOVO
PUMPS—ENGINES—HOISTS

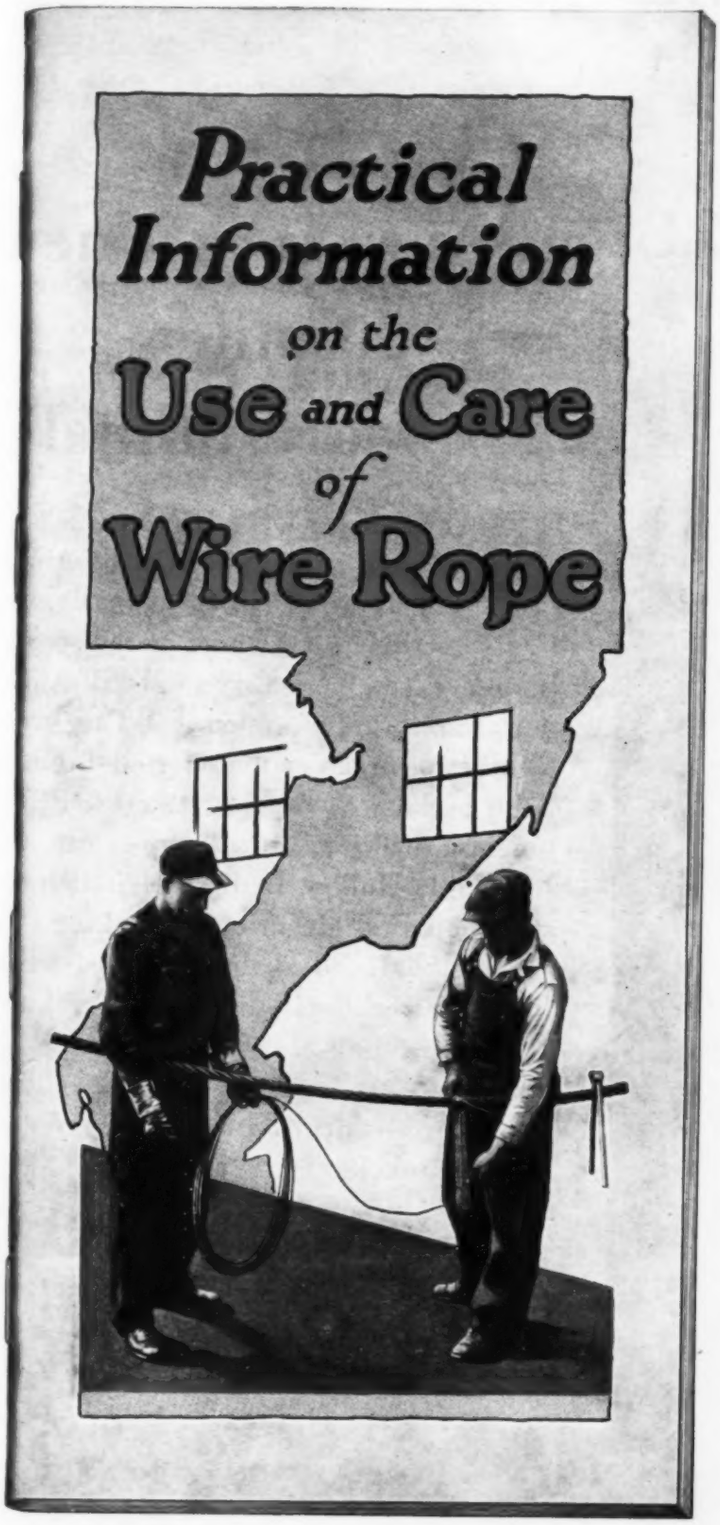
NOVO ENGINE COMPANY, 214 Porter St., Lansing, Michigan
Clarence E. Bement, Vice-President and General Manager

Please send me the Novo Hoisting Handbook and complete data on the New Novo Skid Crane.

Name .....

Address .....

City ..... *State* .....



A Booklet Written for Those Who Want Better Results from The Wire Rope They Use

Your Copy is Ready

If you are interested in getting the very best results from your wire rope—regardless of what make of wire rope you use—write us for a complimentary copy of this booklet.

The life of wire rope is often shortened by improper use and care. This booklet points out the most common of these errors. It also contains illustrated instructions on

How to uncoil wire rope.
How to unreel wire rope.
How to splice wire rope.
How to bind ends of wire rope.
How to attach sockets.
How to attach clips.

If you are having any wire rope problems that are hard to solve, why not let our experienced wire rope engineers help you. Tell us your wire rope troubles, and we shall be glad to give you our recommendations without any obligation on your part.

Established 1857

A. Leschen & Sons Rope Co.
5909 Kennerly Avenue
ST. LOUIS, MO.

NEW YORK:
90 West Street

DENVER:
1554 Wazee Street

CHICAGO:
810 West Washington Blvd.

SAN FRANCISCO:
520 Fourth Street

Published by the Makers of

"Hercules" (RED-STRAND) Wire Rope
Reg. U. S. Pat. Off.

on New York's new 20 mile pressure tunnel

PATRICK McGOVERN, Inc., uses only Crucible Steel Co. of America Hollow Drill Steel in sinking shafts and driving the bore of the second tunnel of New York City's Catskill Aqueduct water supply system. ¶ This great contracting organization selected this drill steel because it is the fastest cutting, toughest drill steel a drill runner can use. ¶ Crucible Hollow Drill Steel is helping speed up this gigantic undertaking. In sinking Shaft No. 6 through hard schist the crew, working in three shifts, sank the 18 ft. 6 in. shaft 108 ft. in 101½ hours—a record. ¶ As for breakage, F. E. Stokes the superintendent on this shaft says "so little is broken it is not worth while figuring the percentage." ¶ Mr. Stokes was picked for his responsible job because of his special fitness and wide experience in modern tunnel driving. He and many men of the drilling crews were brought

east because their experience included work on the Hetch Hetchy, Cascade and Moffat tunnels — three successful projects that pierced through miles of mountains in record time. Crucible Steel Company of America Hollow Drill Steel was used on all these gigantic engineering achievements.

The second pressure tunnel for delivering water from the Catskill Aqueduct to the distribution system of New York City will be 20.2 miles long, all in rock at a depth of 500 ft. or more below sea level. ¶It starts at the Hill View distributing reservoir in Yonkers, crosses beneath the East River at Riker's Island and continues to South Brooklyn. The tunnel will have a clear diameter of 17 ft. for 18.9 miles, and 15 ft. diameter for the final 1.3 mile. The tunnel is being driven from 17 shafts of depths varying from 380 to 780 ft. The carrying capacity of the tunnel is figured as 700 M. G. D. ¶The estimated cost of the tunnel is $64,000,000.

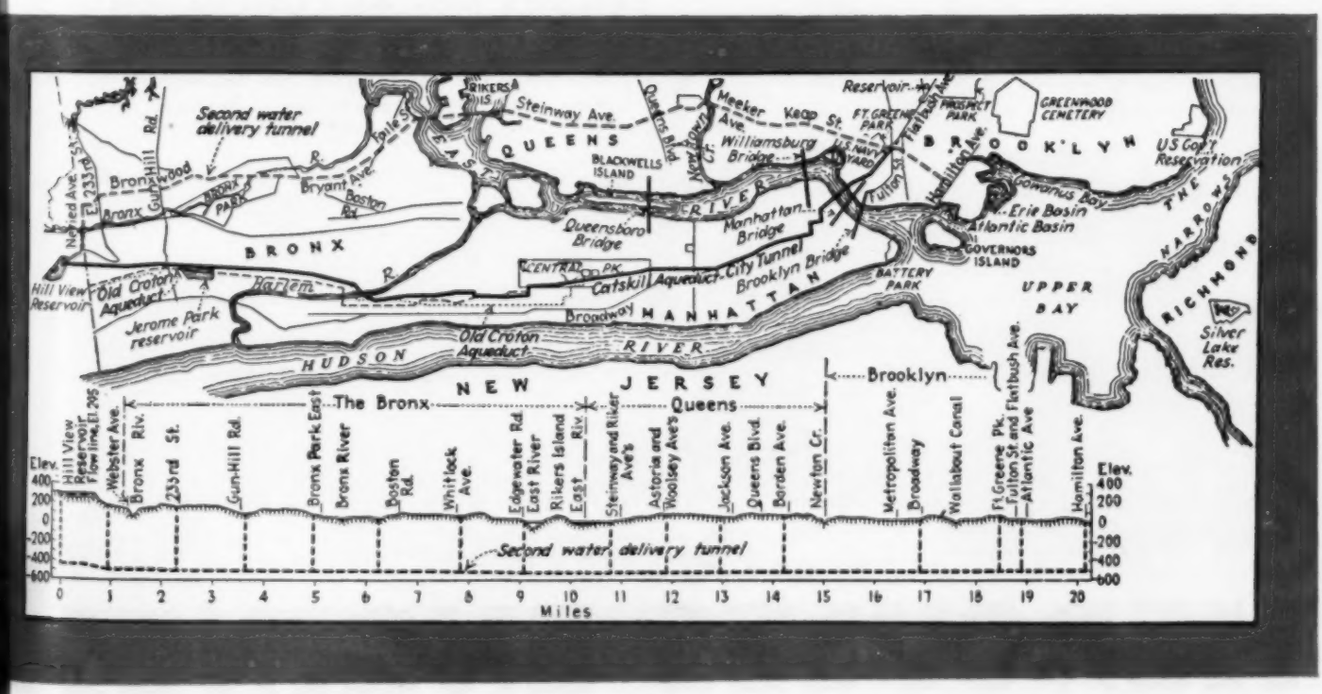
▼ ▼ ▼

CRUCIBLE STEEL COMPANY *of* AMERICA

General Offices: Chrysler Bldg., New York

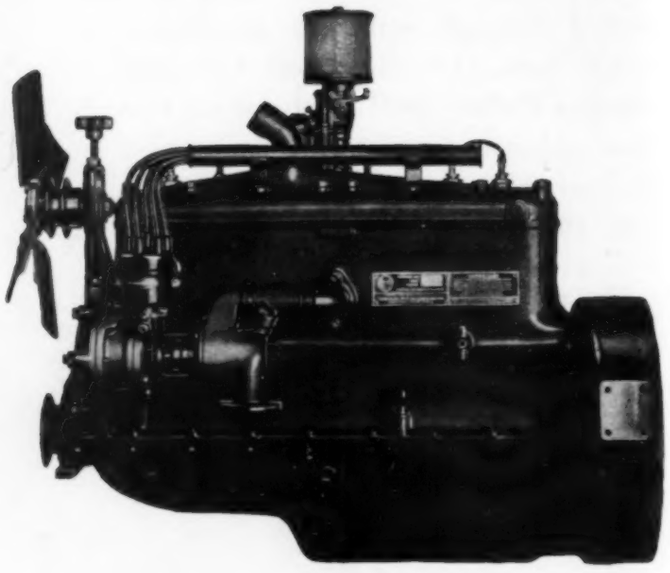
BRANCH OFFICES AND WAREHOUSES

Atlanta	Denver	Philadelphia	St. Paul
Baltimore	Detroit	Pittsburgh	Syracuse
Boston	Hartford	Providence	Montreal
Buffalo	Indianapolis	San Francisco	Toronto
Chicago	Milwaukee	Seattle	London
Cincinnati	New Haven	Springfield	Tokio
Cleveland	New York	St. Louis	



THE HERCULES "JX" MODELS

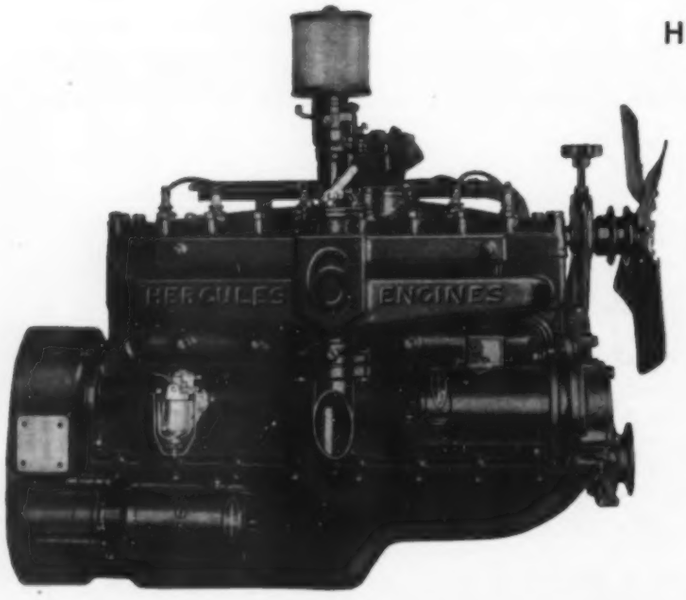
A SERIES OF SMALL HEAVY-DUTY SIXES



FOR applications requiring six-cylinder engines in the lower horsepower ranges, Hercules has developed the "JX" Series.

With exceptional torque ability, large bearing areas, extra-thorough lubrication, high-volume water circulation, seven-bearing crankshaft and other typical Hercules features, the Hercules "JX" Models have been designed particularly to meet the present day need for small, heavy-duty, high-speed engines.

The Hercules "JX" Series, comprising three models, is offered as a companion line to the popular "00" Series of Hercules Fours. They include full provision for all accessories. Complete information and details will gladly be furnished on request.



HERCULES MOTORS CORPORATION
Canton, Ohio, U. S. A.

New York Office: Chanin Building, New York, N. Y.
Mid-Continent Office: Mayo Building, Tulsa, Okla.
West Coast Office: Russ Building, San Francisco, Cal.

SPECIFICATIONS

Model	Bore	Stroke	Displacement
JXA	3-3/8	4-1/4	228 cu. in.
JXB	3-5/8	4-1/4	263 cu. in.
JXC	3-3/4	4-1/4	282 cu. in.

HERCULES ENGINES

You Get INSLEY PERFORMANCE only with an INSLEY

EACH unusual feature of the Half Yard Insley is put there not merely to create fine machinery, but to accomplish some definite operating result that enables the Insley Type "R" to do what other half yard shovels cannot do.

The 6 cylinder engine 53 h. p. (manufacturers rating) with electric starter, for example, is important enough as brute horsepower—but on the Type "R" Insley it is much more important as the source of an even flow of ample power that puts the bucket through hard or easy digging with equal certainty. The starter allows the motor to be cut on or off and thus save fuel and wear on the motor.

Hydraulic brakes controlling both Insley tracks—a fine example in itself of modern design—but much more important in providing positive turning control in either direction from the operator's seat, as well as positive digging brakes in both directions without resorting to makeshift ratchets, dogs or wood blocks.

Roller and ball bearings on all important shafts are fine design—but much more important as the owner's guarantee against loss of power and neglect from the operator.

Insley drum clutches that are perfectly balanced serve to transmit power without booster clutches, bands and toggles—but their positive control in the operator's hand—their operating flexibility—long life—and ease of adjustment keep the operator busy digging dirt instead of relining bands or adjusting clutches twice a day.

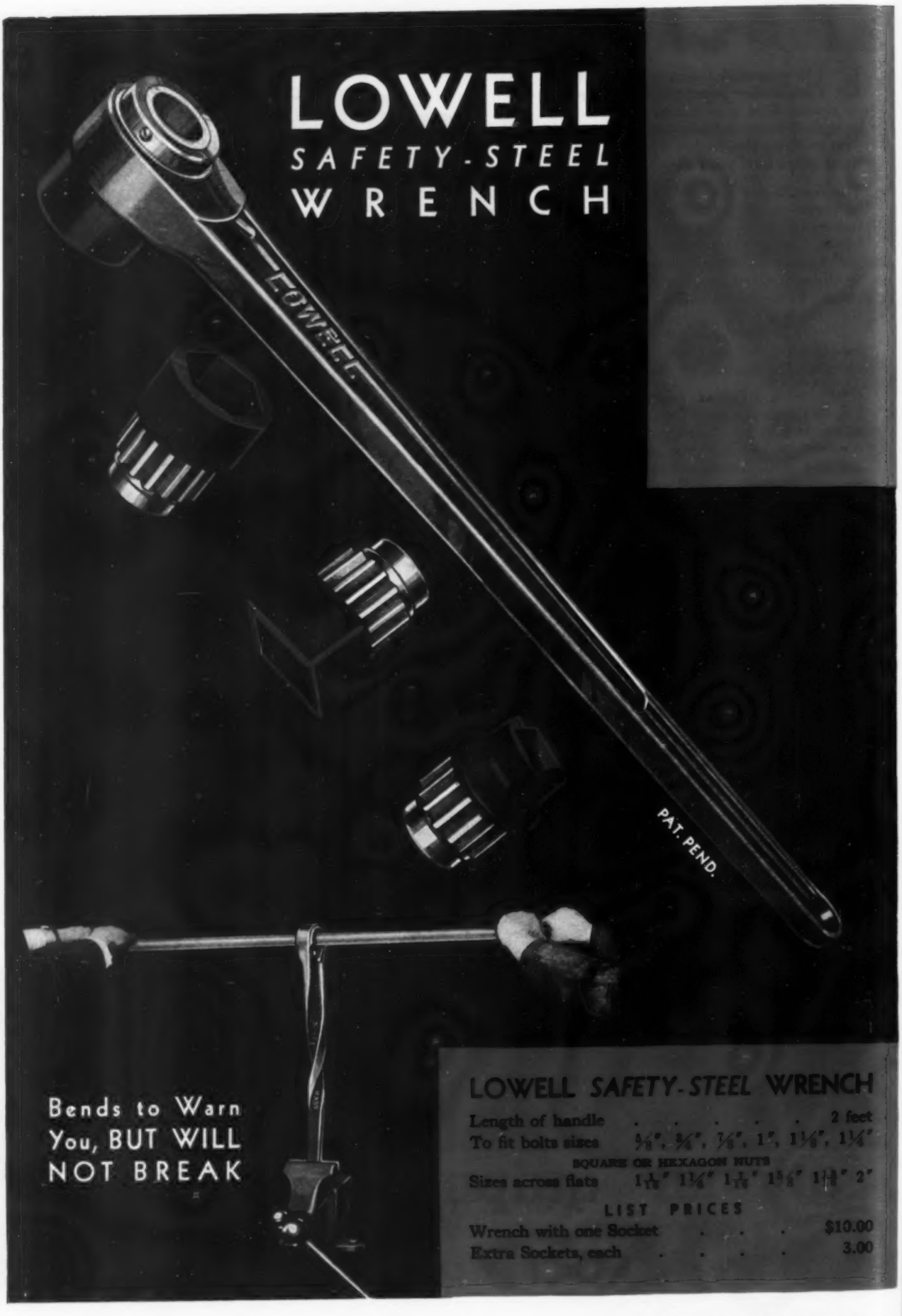
Only a few of many possible examples, but enough to show why the Half Yard Insley is built as it is, how it does what it does, and why you need not expect Insley performance from anything but an Insley.

808

National Equipment Corporation

N. 30th St. & W. Concordia Ave., Milwaukee

LOWELL
SAFETY-STEEL WRENCH



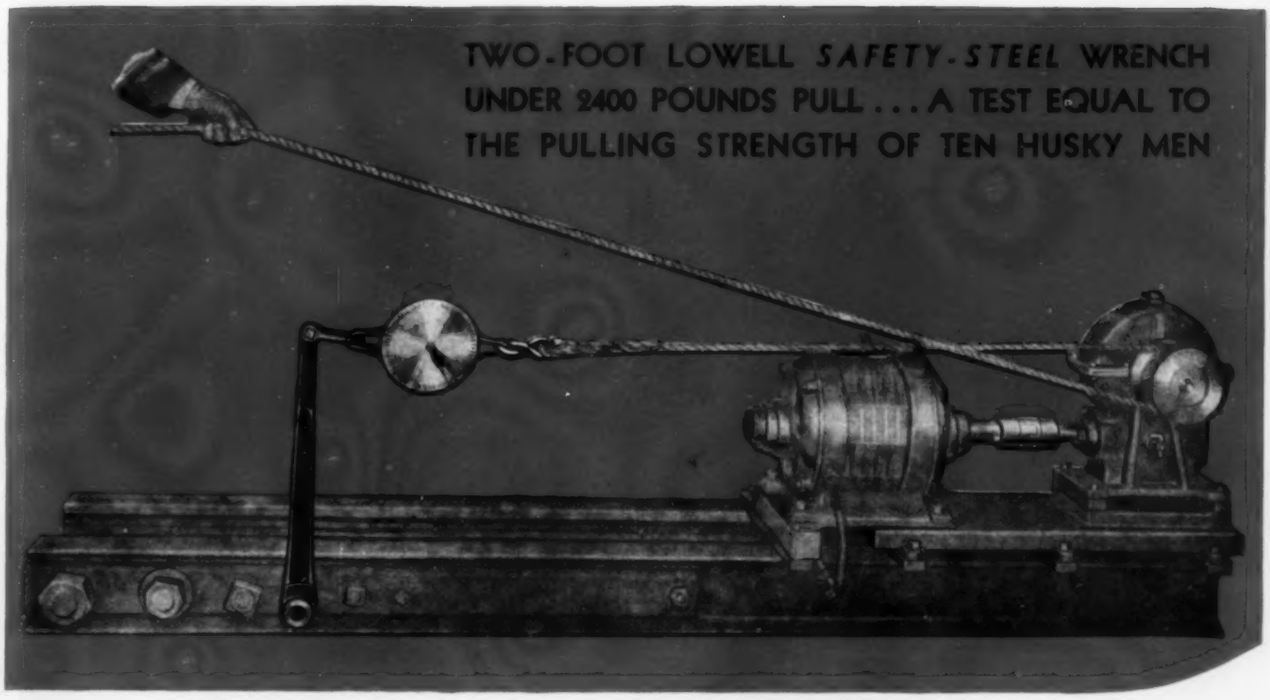
Bends to Warn You, BUT WILL NOT BREAK

LOWELL SAFETY-STEEL WRENCH

Length of handle	2 feet
To fit bolts sizes	⅝", ¾", ⅞", 1", 1⅛", 1¼"
SQUARE OR HEXAGON NUTS	
Sizes across flats	1 1/16" 1⅛" 1 7/16" 1⅝" 1 13/16" 2"

LIST PRICES

Wrench with one Socket	$10.00
Extra Sockets, each	3.00



The New Lowell *Safety-Steel* Wrench Tested to Stand a Pull of 2200 to 2400 Pounds and Guaranteed not to Break . . .

The new Lowell *Safety-Steel* Wrench is made of an electrically treated metal of unusual strength. It is so strong that a 2-foot wrench cannot be bent or broken by ten men. Along with this added strength of metal, Lowell *Safety-Steel* Wrench has full enclosed ratchet and parts that have an absolute crushing action on hardened Steel Pawls.

Every handle of Lowell *Safety-Steel* Wrenches is unconditionally guaranteed not to break . . . a new handle without charge if one breaks. Put them to work soon.

LOWELL WRENCH CO.

WORCESTER, MASS., U. S. A.

PUMP IT HOME WITH SAFETY WITH A LOWELL *SAFETY-STEEL* WRENCH

BUCKEYE
Convertible
REVOLVING
SHOVEL
(3/8-YARD
SIZE ONLY

Profitable Mechanical Features

One-piece manganese steel dipper has reversible teeth and adjustable digging angles; its capacity is .444 cubic yards, struck measure. 19-foot boom, combining flexibility with strength, is rigidly reinforced against lateral distortion. 50 h.p. heavy duty gasoline motor. Fast hoisting, swinging and crowding speeds. Rotating and traveling bases are one-piece electric steel castings. Power steering, with each steel-treaded Alligator crawler driven independently. Convenient one-man control. Electric starter and cab lights.

WILL PAY ITS OWN WAY EVERY DAY

on one construction job or other

Nearly every road, street, sewer and water contract involves some light excavation, handling various materials, frequent shifting of miscellaneous smaller equipment, and the usual "clean-up" operations. ' ' That is a rangy field—one which cannot be serviced profitably by heavier, slower and more expensive construction units. It is, however, exactly the field that Buckeye's 3/8-yard shovel-crane is expressly designed and built to master. In Model O, compactness is supplemented with rugged power; and speed, with thorough dependability. Readily convertible as required to Clamshell, Crane, Dragline, Shovel or Backfiller, this convenient little Buckeye will pay its way every day on work within its capacity. ' ' *At its price,* 3/8-yard Utility Buckeye offers a greater scope of usefulness than ever previously available in any equipment of its class. May we send you complete information?

THE BUCKEYE TRACTION DITCHER CO.
FINDLAY, OHIO

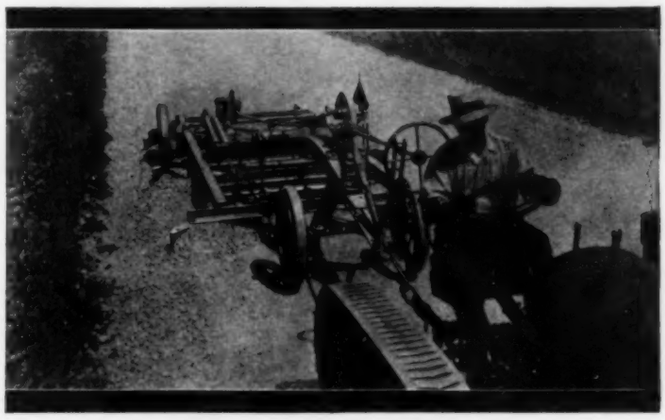
for over thirty years
Buckeye

THERE'S A BUCKEYE SALES AND SERVICE OFFICE NEAR YOU

GALION

Multiple Blade Maintainer

. . . . One Man Control



Levels Earth . . Gravel . . Stone and Retread Roads

Road maintenance is reduced to a simple task with the Galion Multiple Blade Maintainer. Seven blades pass the road material back and forth across a nine foot cut, four times in a single trip, cutting off the high places, filling the holes and leaving a smooth accurately graded road.

Operator of power unit also operates the Maintainer by means of a single control handwheel which is conveniently accessible from his tractor seat. For retread work separate seat and control provide for individual operation.

Furnished with 8 inch blades for general maintenance service or with 12 inch blades for mulch or retread work. Blade extensions can also be furnished to increase cutting width up to 12 feet.

Write for Bulletin No. 107 which describes the many important operating and construction features of this Maintainer.

The Galion Iron Works & Mfg. Co.
GALION, OHIO

FOR SUCCESSFUL PERFORMANCE · A.G.C.-A.

GALION DISTRIBUTORS

ALABAMA, Birmingham—G. C. Phillips Trac. Co., Inc.
ARIZONA, Tucson—F. Ronstadt Co.
ARKANSAS, Little Rock—Murphy & Murphy.
CALIFORNIA, Los Angeles—Smith-Booth-Usher Co.
San Francisco—Jemison Machinery Co.
CANADA, Montreal—Jeffrey Mfg. Co., Ltd.
Vancouver—Brown Fraser & Co., Ltd.
COLORADO, Denver—H. W. Moore Equipment Co.
CONNECTICUT, New Haven—Power Equip. & Serv. Co.
GEORGIA, Atlanta—R. S. Armstrong & Bros.
ILLINOIS, Rockford—Standard Road Equipment Co.
Peoria—The A. E. Hudson Co.
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IOWA, Des Moines—Dukehart Machinery Co.
KANSAS, LaCrosse—F. E. Vaughn.
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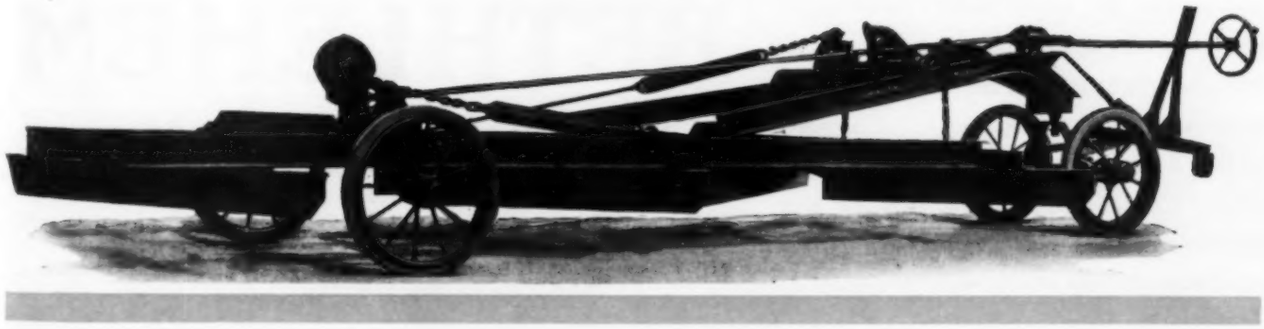
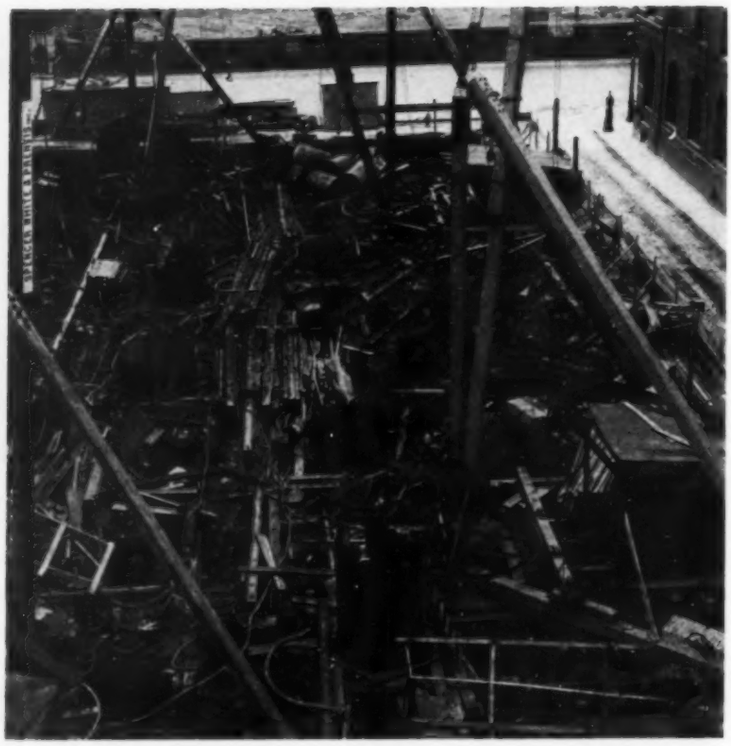
Raleigh—North Carolina Equip. Co.
NORTH DAKOTA, Fargo—Lewis Tractor & Mchy. Co.
OKLAHOMA, Enid—Bert Smith.
Oklahoma City—Herd Equipment Co.
OREGON, Portland—Feenaughty Machinery Co.
TENNESSEE, Memphis—W. D. Banker Road Mchy. Co.
Nashville—Tennessee Tractor Co.
TEXAS, San Antonio—Lewis-Patten Co.
Houston—The R. B. Everett Co.
UTAH, Salt Lake City—C. H. Jones Co.
VIRGINIA, Richmond—Richmond Machy. & Equip. Co.
WEST VIRGINIA, Huntington—Banks Miller Sup. Co.
Welch—Welch Good Roads Sup. Co.
WISCONSIN, Milwaukee—Badger Trac. & Equipment Co.



LACKAWANNA PILING SECTION SP8a

used in foundation for 31-story office building

Looking down into one of the 6-ft. dia. Lackawanna Piling caissons, driven to 40-ft. below the curb.



Site of the 31-story building at 21 West St., New York City, during the driving of the 42 Lackawanna Piling caissons that were required for the foundation.

Forty-two 6-foot diameter caissons were required for the foundation for the 31-story office building at 21 West Street, New York City. These caissons were built with 8½-in. x ⅜-in. Lackawanna Straight Web Piling, Section SP8a, in lengths of 28 to 30 feet, driven through river silt and quicksand to rock, 40 feet below the curb. The foundation was completed in only 27 working days.

Spencer, White & Prentis, New York City — Foundation Contractors

Lackawanna Section SP8a is especially suitable for caisson construction. Its 8½-inch width makes possible the formation of very small diameters, while its light weight permits handling, assembling and driving with comparatively light equipment. Morever, it has a ⅜-in. web which, with the strong interlock, contributes to the sturdiness that has made this piling so successful on numerous projects.

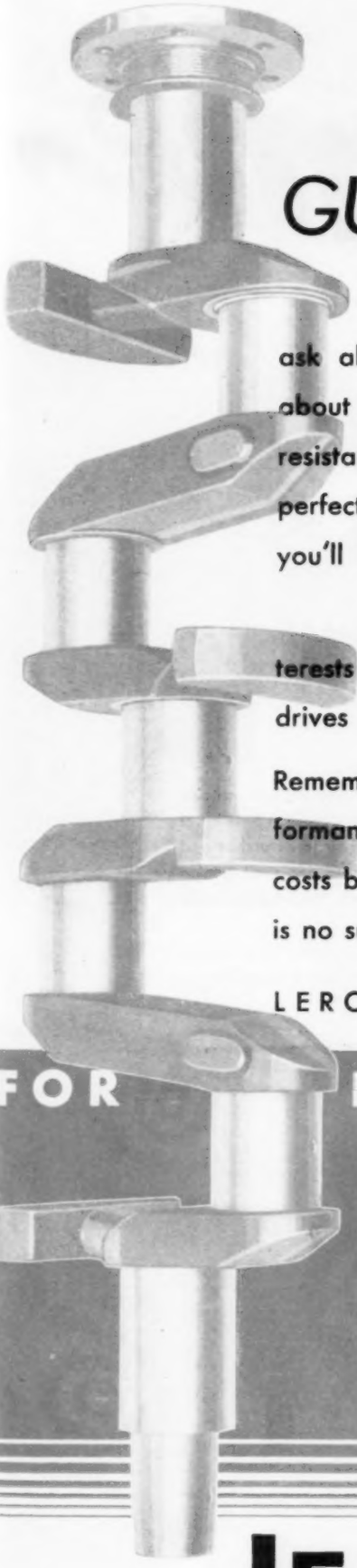
BETHLEHEM

BETHLEHEM STEEL COMPANY, General Offices; Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Buffalo, Pittsburgh, Cleveland, Cincinnati, Detroit, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Seattle, Portland, Honolulu.

Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.



Look to the LEROI for *GUARANTEED* protection

When considering power operated machinery, ask about the LeRoi and its guaranteed crankshaft . . . ask about its large factor of safety . . . its massive strength . . . its resistance to heavy shocks and high torques. Find out about its perfect balance . . . alignment, large bearing surfaces and you'll know why it is guaranteed for the life of the engine.

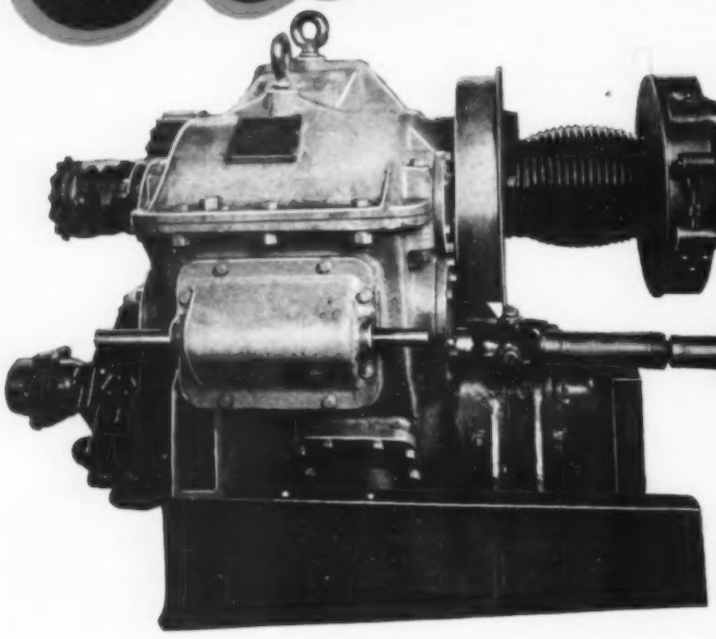
Know why LeRoi power protects the user's interests . . . why it can do your work in less time . . . and why it drives down costs and makes even the low bids pay out . . .

Remember, the LeRoi has wide acceptance for dependable performance, year after year . . . its surprisingly low maintenance costs bear tribute to its sound design and construction . . . there is no substitute for LeRoi power. Demand it on your equipment.

LEROI COMPANY, *Milwaukee, Wisconsin*

LE ROI ENGINES

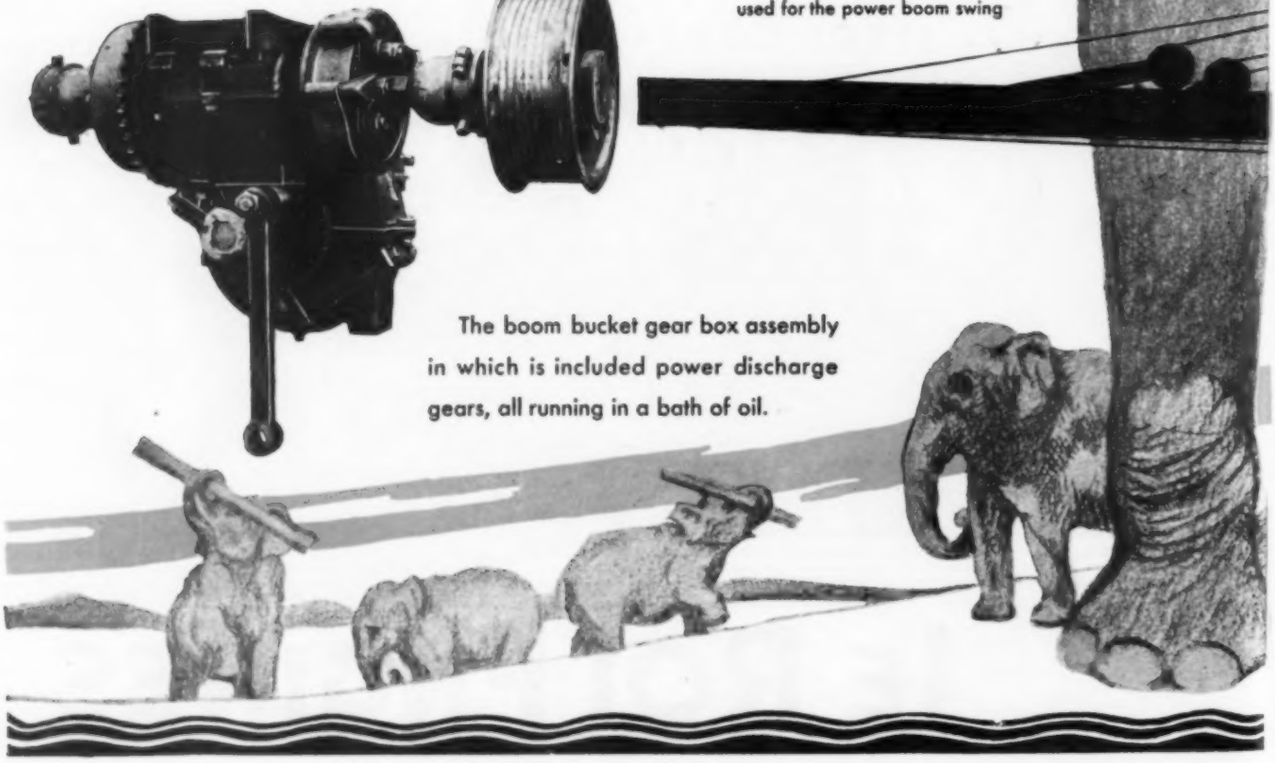
Ransome



The main Gearing Box contains reduction gears, traction drive bevel gears with their jaw clutches and change-of-speed gears, all running in a bath of oil. Note the accessible construction.

A third enclosed gear box is used for the power boom swing

The boom bucket gear box assembly in which is included power discharge gears, all running in a bath of oil.



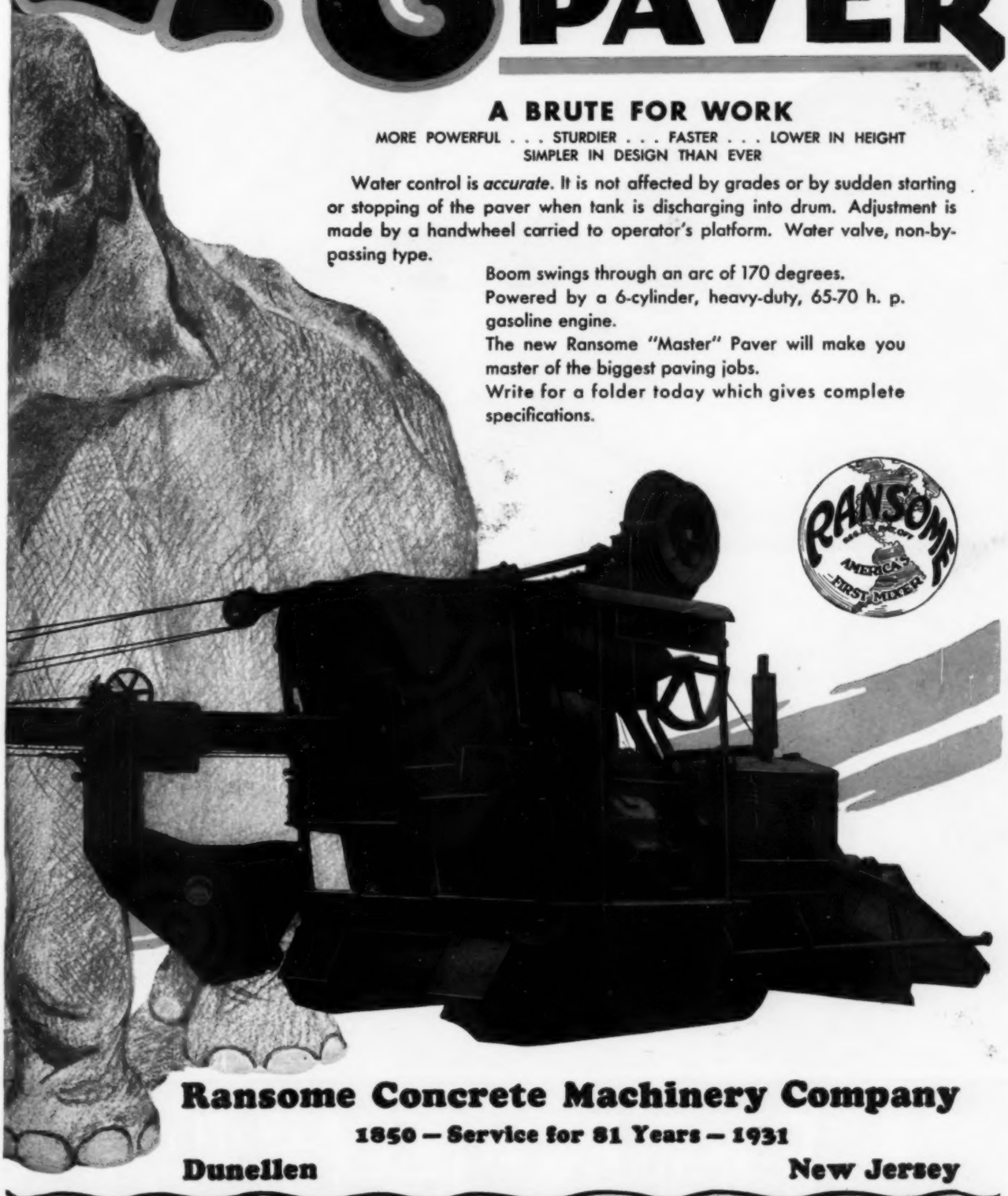
27-E MASTER PAVER

A BRUTE FOR WORK

MORE POWERFUL . . . STURDIER . . . FASTER . . . LOWER IN HEIGHT
SIMPLER IN DESIGN THAN EVER

Water control is *accurate*. It is not affected by grades or by sudden starting or stopping of the paver when tank is discharging into drum. Adjustment is made by a handwheel carried to operator's platform. Water valve, non-by-passing type.

Boom swings through an arc of 170 degrees.
Powered by a 6-cylinder, heavy-duty, 65-70 h. p. gasoline engine.
The new Ransome "Master" Paver will make you master of the biggest paving jobs.
Write for a folder today which gives complete specifications.



Ransome Concrete Machinery Company

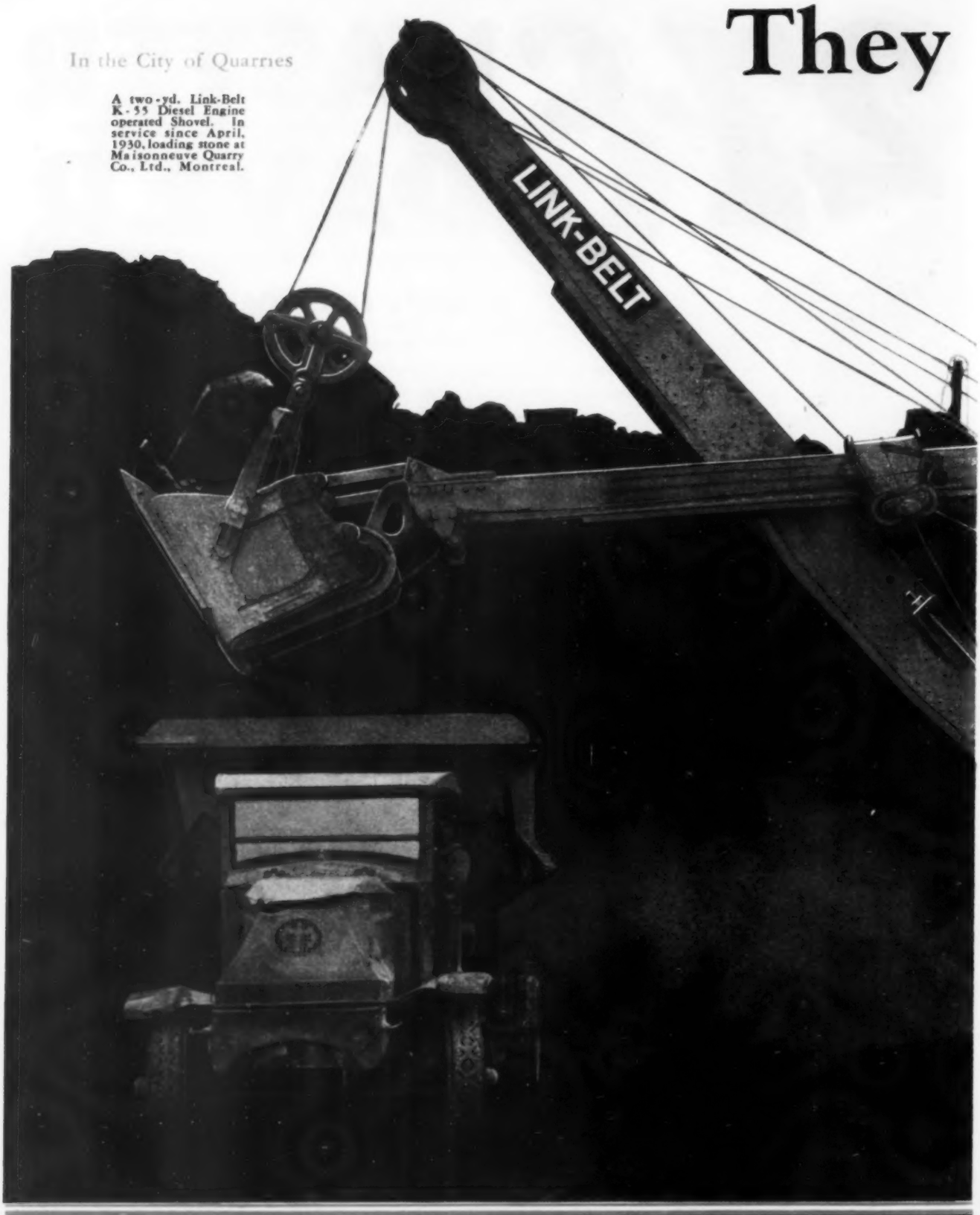
1850 — Service for 81 Years — 1931

Dunellen **New Jersey**

They

In the City of Quarries

A two-yd. Link-Belt K-55 Diesel Engine operated Shovel. In service since April, 1930, loading stone at Maisonneuve Quarry Co., Ltd., Montreal.



LINK-BELT

Buy LINK-BELTS on PERFORMANCE

IN the last analysis there is just one thing that you want to know about any machine. What can it do—in short, "performance!" ¶ It is a fact that Link-Belts do come through on the hard jobs—assure more yardage per day—more jobs—more profits from each. Each Link-Belt is built for HEAVY-DUTY service, to meet the maximum demands that may be made upon it. ¶ Readily converted to any of nine boom assemblies. From ¾ to 2½ yd. capacity. Gas, Diesel or electric. Every model can be shipped on a flat car without dismantling. Send for book.

LINK-BELT COMPANY
300 WEST PERSHING ROAD, CHICAGO
Link-Belt offices and distributors in all principal cities

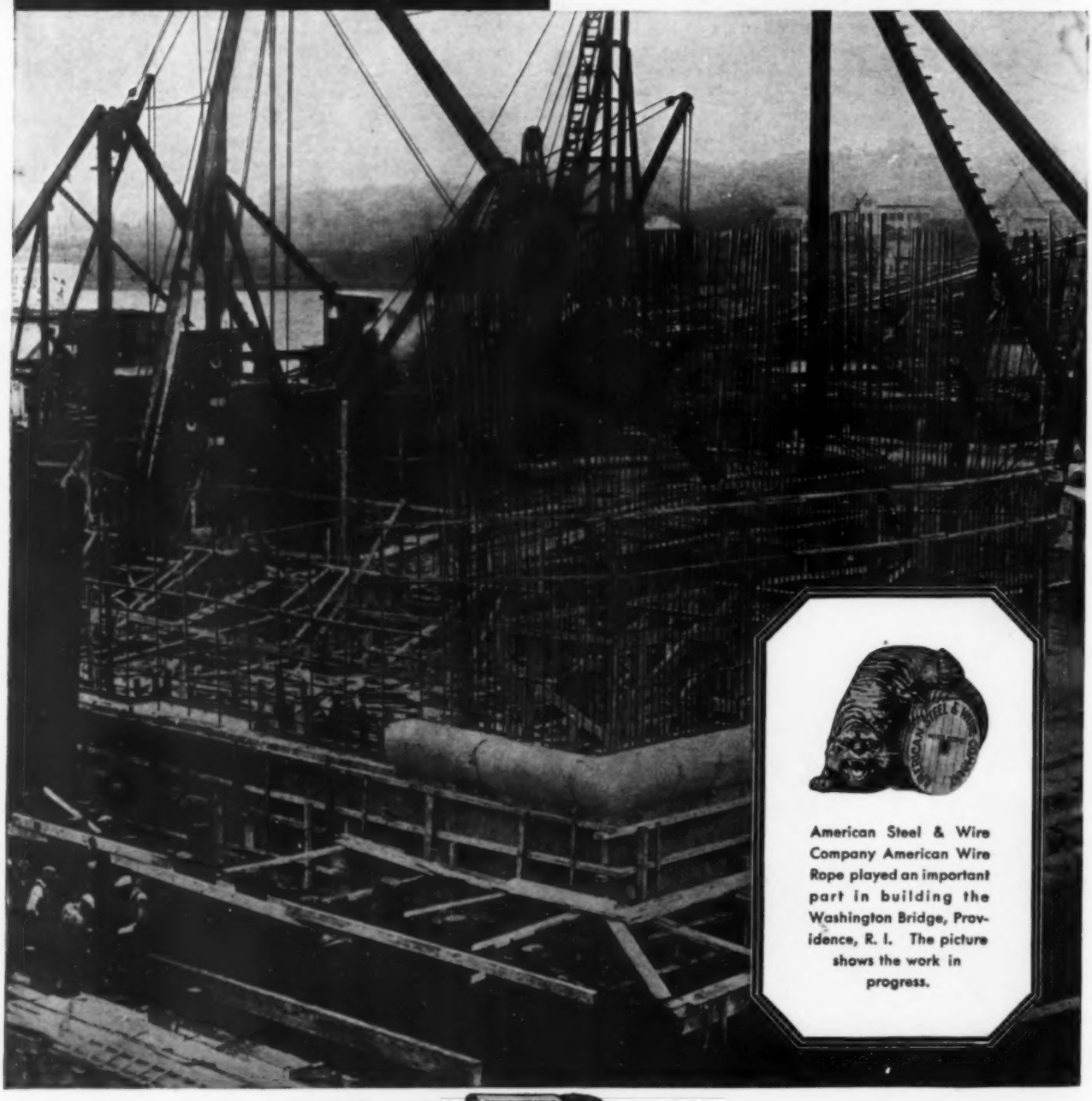
4275

SHOVEL · CRANE · DRAGLINE
"BUILT-FOR-SERVICE"

AMERICAN
STEEL & WIRE COMPANY
WIRE ROPE

Meets . . . . .
Every Construction Demand

Only an outstanding degree of superiority in construction work, could have won an almost universal demand for American Steel & Wire Company Wire Rope. Ability to stand up under the most gruelling punishment—marked reduction in replacement costs—and constant dependability, are reasons why it is generally specified. Made by the American Steel & Wire Company—you are assured of dependable service and a rope exactly suited to your needs. Today—consult our nearest office or distributor.



American Steel & Wire Company American Wire Rope played an important part in building the Washington Bridge, Providence, R. I. The picture shows the work in progress.

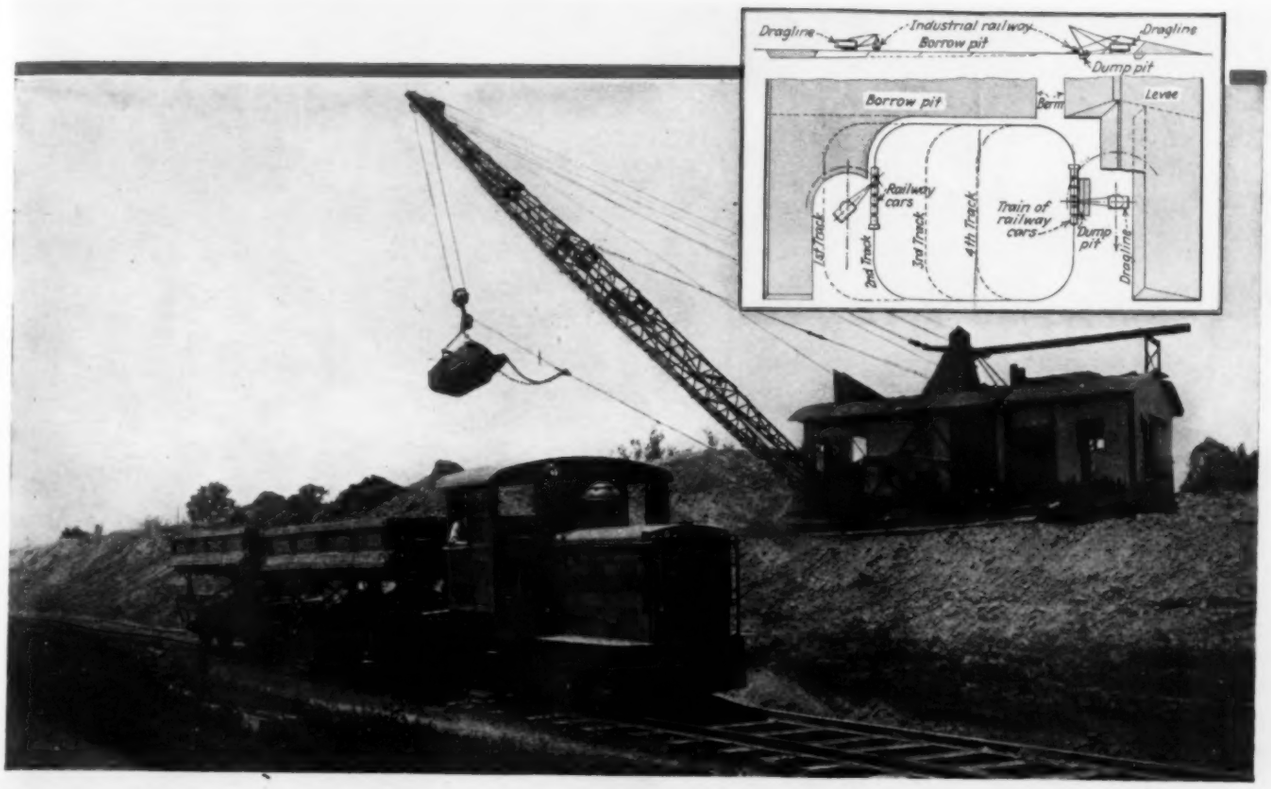
1831 — 1931

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago — SUBSIDIARY OF UNITED STATES STEEL CORPORATION — And All Principal Cities

Pacific Coast Distributors: Columbia Steel Company, Russ Building, San Francisco

Export Distributors: United States Steel Products Company, New York



Canal Construction Co's 4 Plymouth Locomotives HELP TO CONTROL "OLD MAN RIVER"

CANAL CONSTRUCTION COMPANY
CANAL DREDGING COMPANY
MEMPHIS, TENN.

October 16, 1930.

Mr. D. T. Gildhart,
c/o Pidgeon Thomas Iron Co.,
Memphis, Tenn.

Dear Mr. Gildhart:

In reply to your query regarding the Plymouth Locomotives, we have purchased from you, would say that we are using all of these in connection with the Shea Method of levee building.

In this method, there are three factors, which enter into one unit, all dependent on each other for perfect co-ordination in order to produce high efficiency.

It necessarily followed, that we used great care in the selection of motive power for our transporting factor. Our repeat orders show that our selection was satisfactory to us.

Very Truly Yours,

Canal Construction Co.

By- S. C. Harvey

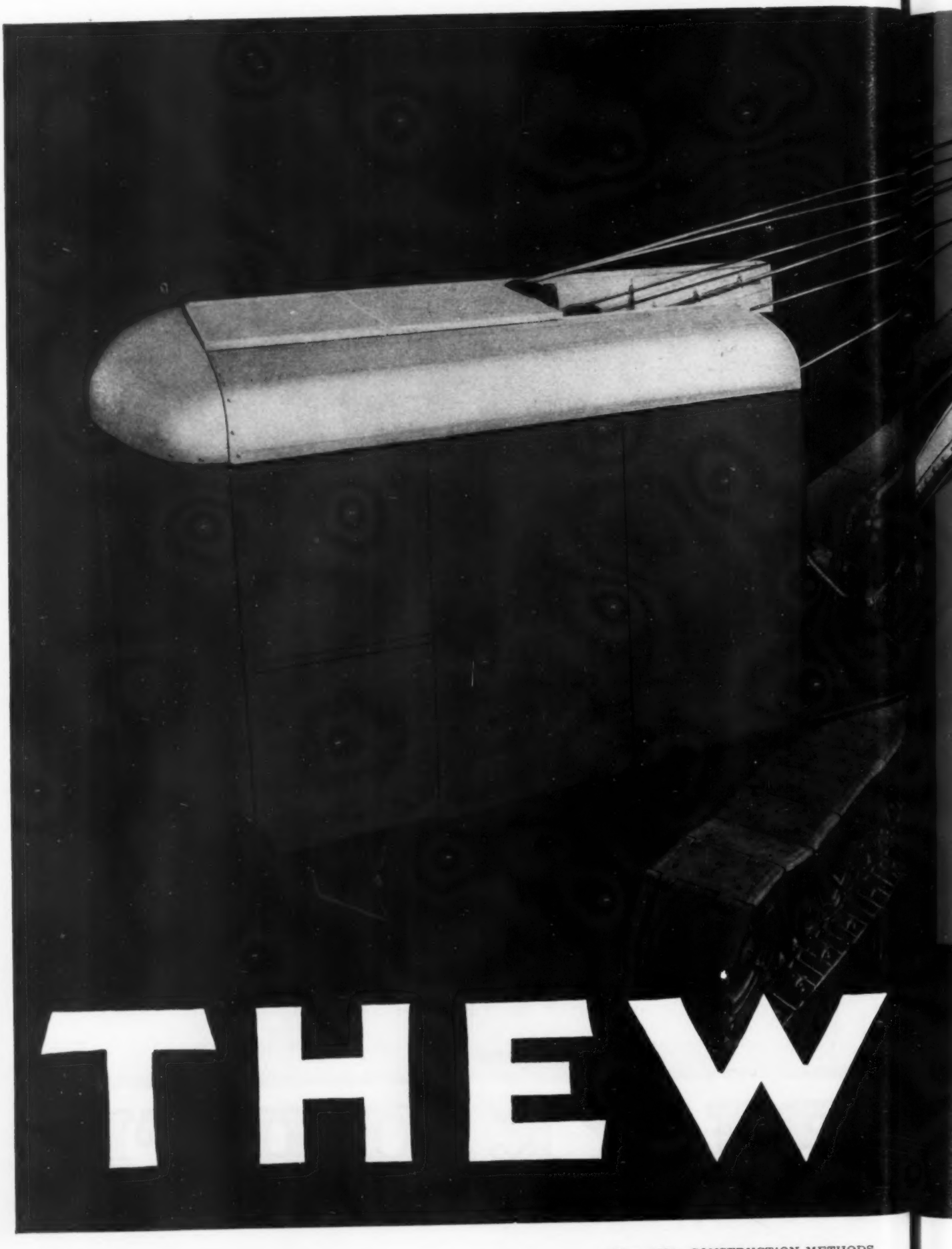
R

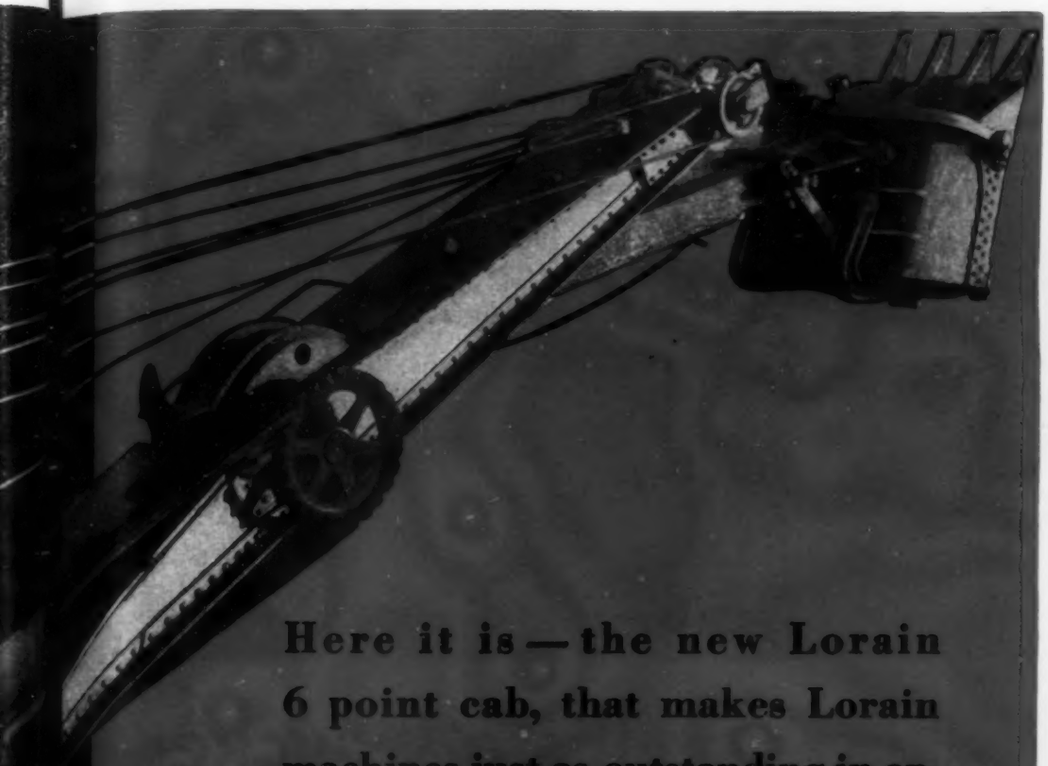
T. F. Shea, of Canal Construction Co., Memphis, Tennessee, developed and patented the loop railway system of haulage for use in levee construction where long hauls between borrow pit and levee section are necessary. Note above sketch showing trackage and equipment placement. Canal Construction Company own and employ four Plymouth Locomotives in connection with their levee-building work along the Mississippi River. Here Plymouths are daily helping to build the levees that are to keep "Old Man River" in his old natural course. Read Mr. Harvey's letter. Send for your copies of PLYMOUTH performance bulletins.

PLYMOUTH LOCOMOTIVE WORKS
The Fate-Root-Heath Company
PLYMOUTH, OHIO

PLYMOUTH

Gasoline and Diesel Locomotives


THEW



Here it is — the new Lorain 6 point cab, that makes Lorain machines just as outstanding in appearance, as the powerful Center Drive is, in operation. The Lorain cab again shows Thew's attention to detail. Look over the distinctive features described here.

THE THEW SHOVEL CO., *Lorain, Ohio*

The

LORAIN

6 *Point Cab*

Ventilation Accessibility
Visibility Appearance
Safety Protection

THE new Lorain cab has 5 sliding doors, operated from inside the cab. They open up 108 square feet, or about half the side and rear area of the cab, for ventilation and visibility. When the machine is not in use, these doors lock up like a safe, protecting mechanism and tools.

Three full length sliding doors comprise the back, permitting opening any ⅔ of the back for ventilation or accessibility to the motor.

The new cab is stronger. It is of steel construction with extra strength at the corner posts. It is weatherproof, with a heat-deflecting, aluminum painted roof.

The cab is cut away to give clear vision to the operator when he swings the cab around. There are non-skid floor plates.

The smart appearance of this cab with its new streamlines — even the counterweight is streamlined — makes this a machine you will be proud to own, a symbol of the efficiency which Lorain Center Drive machines bring to any job.

LORAIN

It's a Quicker LESS COSTLY WAY *with* CLETRAC

NINE times out of ten when these powerful, sure-footed Cletrac Crawlers take over a job they upset all former operating standards. With their faster travel they put new speed into schedules. They trim down costs through their remarkable economy of gas and oil and smaller service requirements. Their higher percentage of delivered working power gets extra capacity out of equipment and permits bigger loads.

Regardless of the kind of work—handling a scraper train, pulling an elevating grader, pushing a bulldozer, or doing any one of scores of outdoor jobs—Cletrac Crawlers put new vim and vigor into the operation and save a great many dollars in a season's time.

Cletrac Crawlers are built for rough going and tough tasks. They handle easily with their simplified controls and patented planetary gear steering. All models have automatic lubrication which does away with daily hand oiling and greasing and safeguards the tractor against neglect or service oversights.

Cletrac Crawlers are built in a complete line of five sizes with deliveries of from 15 to a maximum of 80 horsepower.

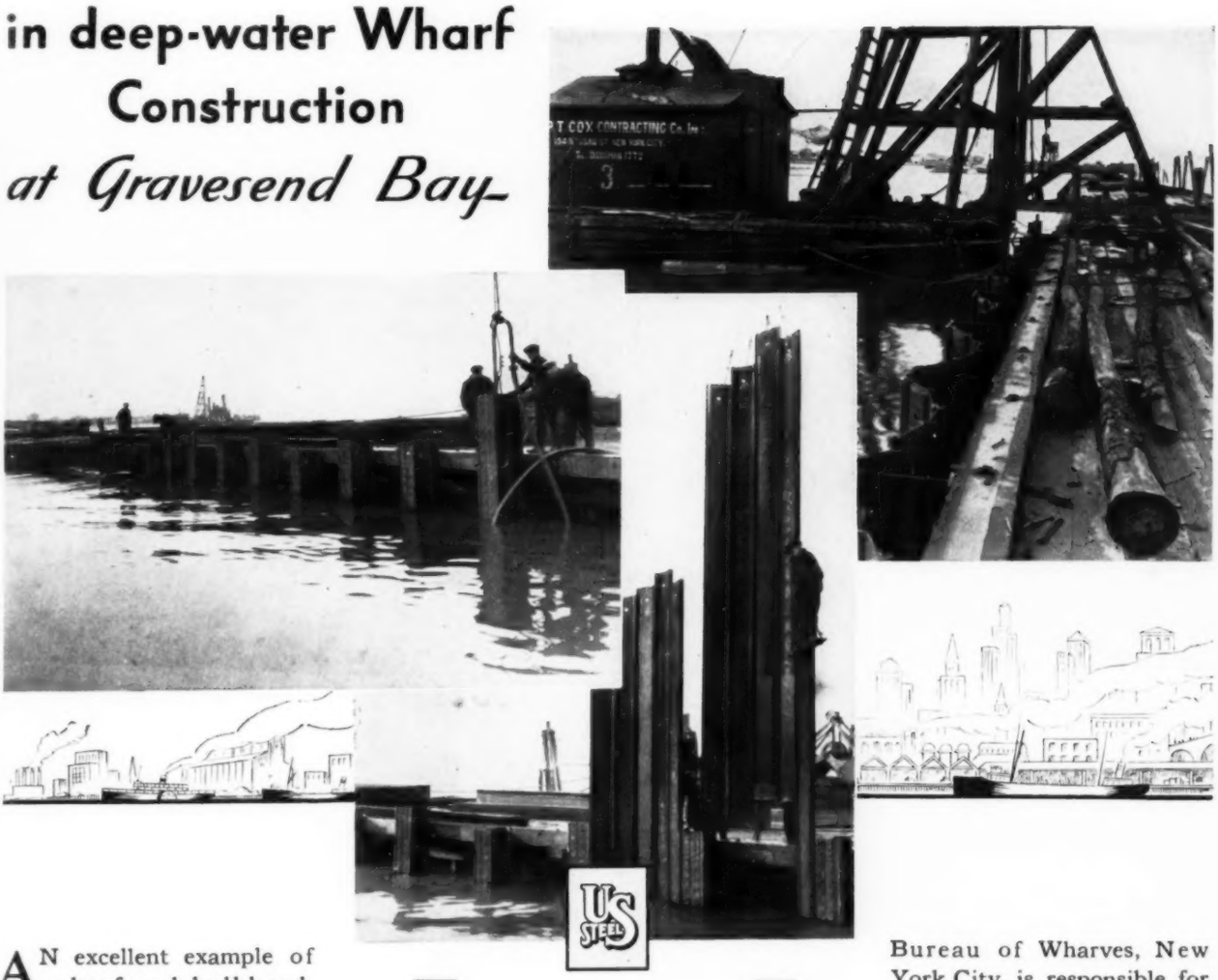
Cletrac
Crawler Tractors

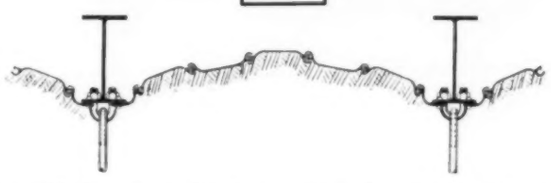
Get in touch with a Cletrac dealer for a demonstration and first hand facts about these better tractors — or write direct for literature and information.

THE CLEVELAND TRACTOR COMPANY
19323 Euclid Avenue CLEVELAND, OHIO

CARNEGIE PILING • •

in deep-water Wharf Construction *at Gravesend Bay*





AN excellent example of wharf and bulkhead, combining Carnegie Steel Sheet Piling and C B Sections in its construction, is illustrated above. This type of construction is economical, rugged and durable and can be applied to any depth of channel and any surcharge load by varying the weight of the C B Sections and the spacing of the master piles. Mr. M. Lenke, Chief Division Engineer, Bureau of Wharves, New York City, is responsible for the design. The P. T. Cox Contracting Company were the general contractors.

Carnegie Steel Sheet Piling is rolled in an efficient range of weights and sizes. Suggestions, including design if desired, will be furnished for your problems . . .

CARNEGIE STEEL COMPANY, Pittsburgh, Pa.,
Subsidiary of United States Steel Corporation

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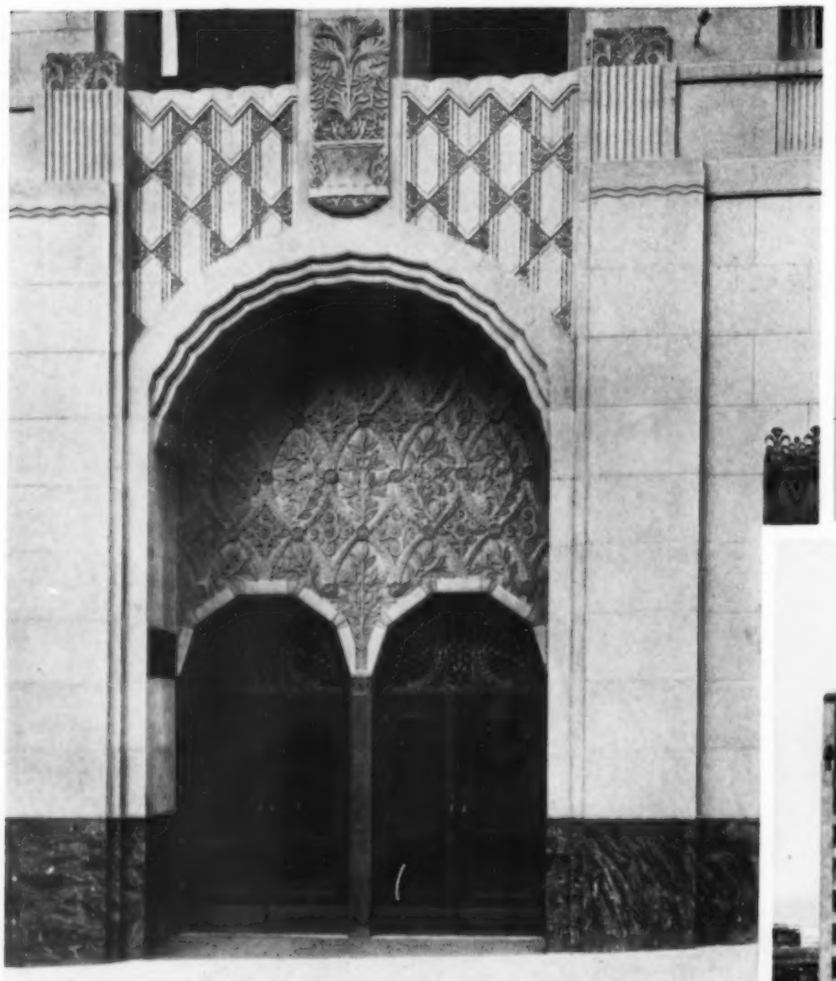
CARNEGIE
STEEL SHEET PILING



The exterior of the Exchange Building, Seattle, is of cast stone made with Atlas White portland cement. John Graham, architect. . . . A. W. Quist Co., general contractor, both of Seattle. Cast stone furnished by Pacific Stone Co., Seattle. ***These pictures faithfully reproduce the color of the cast stone exterior of this building.***

Exterior Faced with Cast Stone

of ATLAS WHITE Portland Cement

FEW materials produced or manufactured for the facing of buildings lend themselves to color treatment more perfectly than does Atlas White cast stone. With it is secured a wide variety in both color and texture. Atlas White cast stone thus opens a much broader field in the conception of building exteriors.

Truest color tones in the matrix of a cast stone are produced with a neutral white base. Likewise, the full color value of stone used for aggregate is brought out best with white portland cement. For these reasons Atlas White portland cement, which is available both plain and waterproofed, is used from coast to coast for fine cast stone.

86a

CONCRETE FOR PERMANENCE

Universal Atlas Cement Co.

Subsidiary of United States Steel Corporation

CHICAGO · NEW YORK · PITTSBURGH · MINNEAPOLIS · ST. LOUIS

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Construction Methods

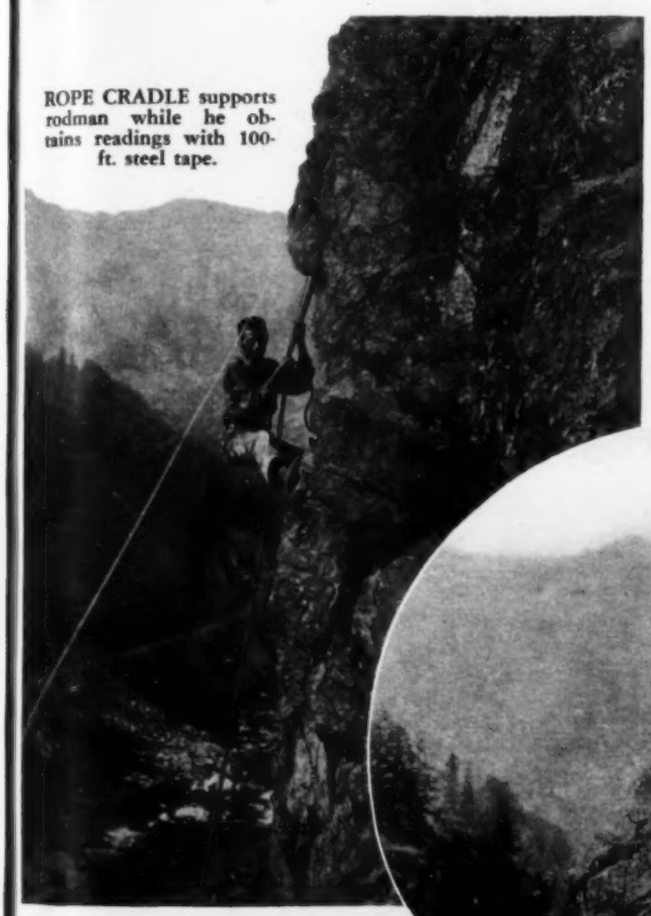
A McGRAW-HILL PUBLICATION—ESTABLISHED 1919

ROBERT K. TOMLIN, *Editor*

VOLUME 13 NEW YORK, MAY, 1931 NUMBER 5

Bridge Site Surveyed by

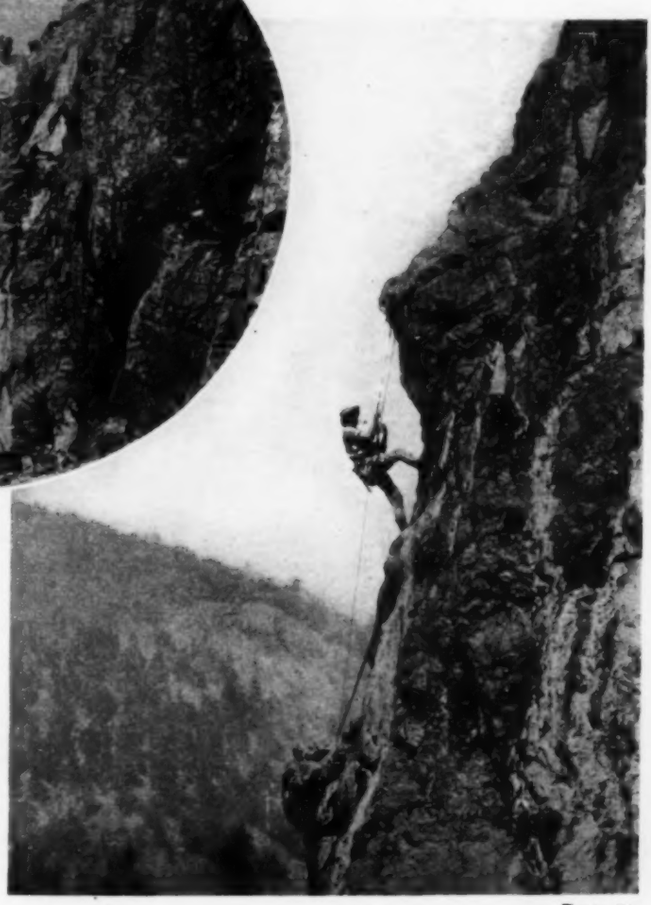
CLIFF-CLINGING ENGINEERS



ROPE CRADLE supports rodman while he obtains readings with 100-ft. steel tape.

rodman in a rope cradle. This $\frac{5}{8}$-in. line was snubbed around an iron pin in the rock. The rodman obtained a series of readings from top to bottom of the 100-ft. cliff, then moved over a few feet and got another series as he climbed up.

NARROW LEDGE *(above)* **in face of cliff offers cramped quarters for transit set-up.**

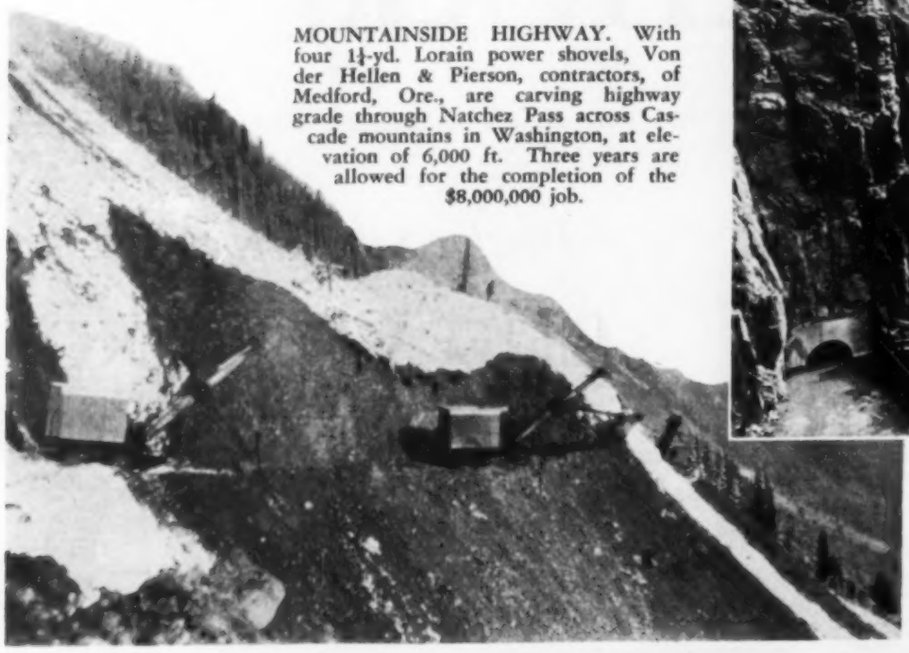


GOING TO WORK *(right)*. **Hemp rope is only path by which surveyor may reach location of the day's operations.**

HANGING almost literally by an eyelash, surveyors, under the direction of A. D. Hunting, chief of party for the state Department of Public Works, mapped the precipitous face of a cliff as a preliminary to locating the east arch hinge of a bridge across the Feather River near Pulga, Calif. On account of the almost vertical slopes at the site, the stadia method was abandoned in favor of readings by direct measurement with a 100-ft. steel tape.

To support the rodman while obtaining the necessary shots, a 1-in. hemp rope was hung over the cliff and anchored at the top to an 8-in. pine tree. A second $\frac{5}{8}$-in. line served to support a

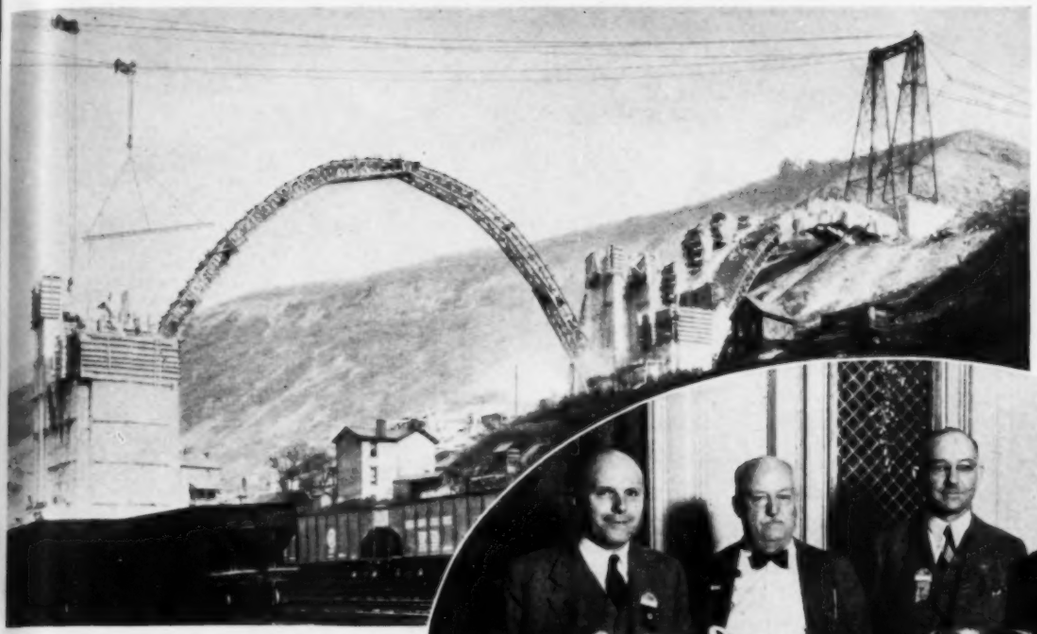
This Month's
"News Reel"



MOUNTAINSIDE HIGHWAY. With four 1¼-yd. Lorain power shovels, Von der Hellen & Pierson, contractors, of Medford, Ore., are carving highway grade through Natchez Pass across Cascade mountains in Washington, at elevation of 6,000 ft. Three years are allowed for the completion of the $8,000,000 job.

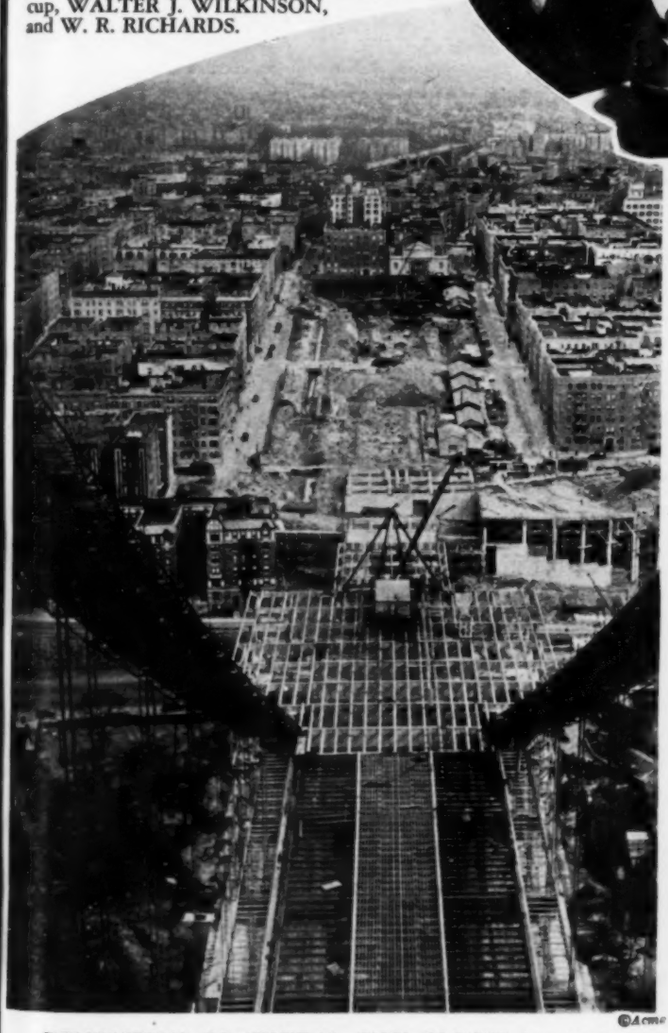
OWYHEE DAM on U. S. Bureau of Reclamation project in Oregon takes form. Using 8-yd. cableway bucket, General Construction Co., of Seattle, deposits concrete in radial blocks of arched gravity structure, to reach ultimate height of 530 ft.

DRIVES LAST RIVET IN NEW McGRAW-HILL BUILDING *(left)*. On April 9, MASON BRITTON, vice-president of company publishing *Construction Methods* and other engineering and industrial journals, completes steel frame for 33-story structure at 342 West 42nd St., New York, with E. D. CONKLIN, vice-president, *(at left of column)* acting as "bucker-up." Attending rivet-driving ceremony are: *(right)* A. H. PETERSON, general superintendent, and COL. W. A. STARRETT, president, Starrett Bros. & Eken, Inc., contractors for McGraw-Hill building and J. A. FOUILHOUX, associate of Raymond Hood, Godley & Fouilhoux, architects.



FIRST ARCH CENTERING *(left)* for Westinghouse Memorial Bridge at East Pittsburgh, Pa., is placed by Booth & Flinn, Ltd., contractors. Concrete structure on Lincoln Highway route across Turtle Creek will cross valley 1,510 ft. wide. Longest of five ribbed arches will have record-breaking span of 425 ft. Allegheny County Dept. of Public Works, Norman F. Brown, director, is in charge of construction.

CONSTRUCTION SAFETY REWARDED *(right)*. Cups for accident prevention received by A.G.C. members at recent annual convention. *(Left to right)* A. E. HORST, donor of cup, JAMES E. CASHMAN, winner of Goble cup, WALTER J. WILKINSON, and W. R. RICHARDS.



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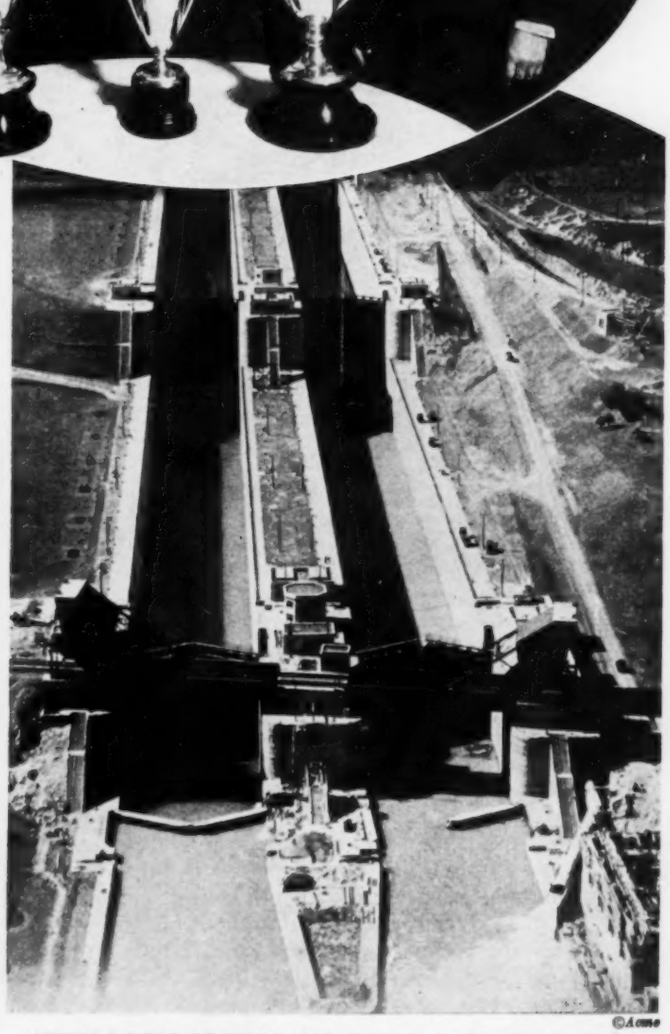
DEMOLITION OF SEVERAL CITY BLOCKS has been necessary to provide an approach to the New York end of the Hudson River bridge, now nearing completion. Roadway construction on approach span in progress.



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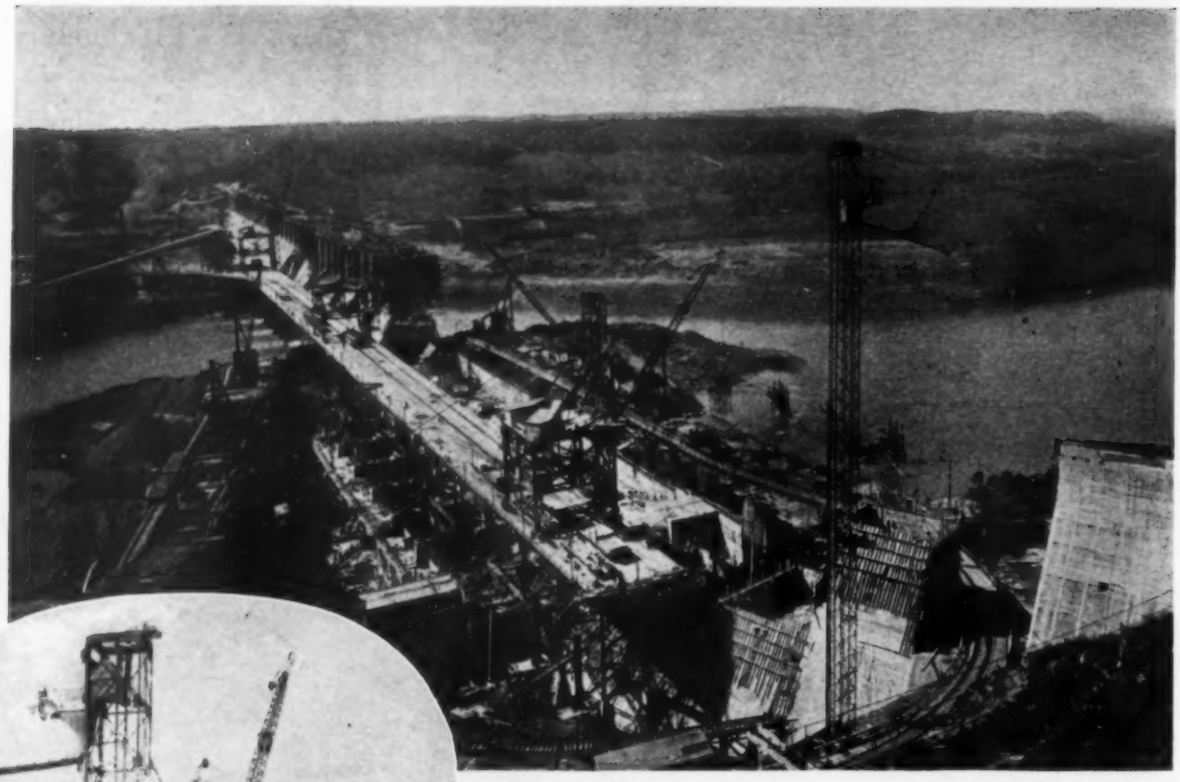
TWIN LOCKS OF WELLAND CANAL, in Canada, are ready for service. Each lock in flight of three at Thorold, Ont., has 46½-ft. lift. With total of seven locks, new canal overcomes drop of 326½ ft. between Lake Erie and Lake Ontario.

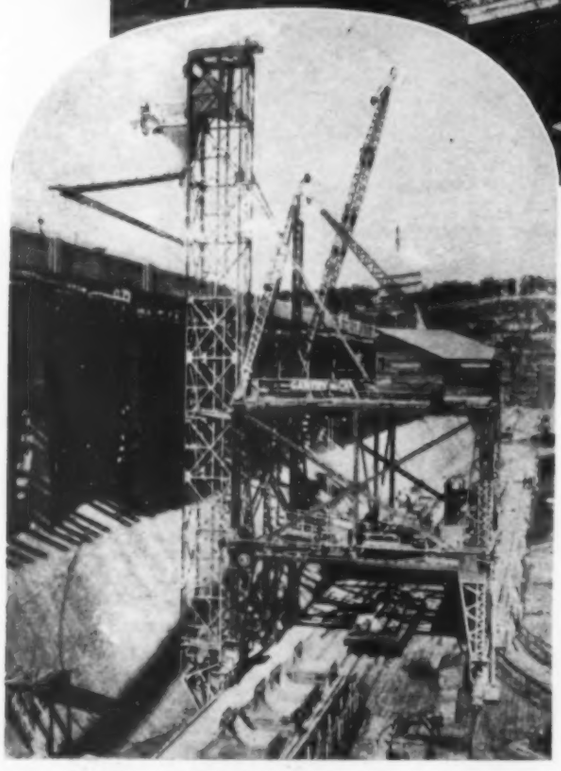


CONSTRUCTION OF POWER HOUSE SECTION progresses rapidly inside cellular cofferdam. Long bridge carrying railway cars and traveling gantries expedites delivery of concrete to dam.

FAST CONCRETING

Speeds Completion of Osage River

POWER PROJECT



GANTRY TRAVELER on construction bridge is equipped with concrete hoist tower and steel stiff-leg derrick.

REMARKABLY fast concreting progress and extensive use of cellular sheet-pile cofferdams have distinguished the construction of the 2,543-ft. long concrete dam and generating station on the Osage River, near Bagnell, Mo., by the Stone & Webster Engineering Corporation for the Union Electric Light and Power Co. The contractor has placed as much as 113,000 cu.yd. of concrete in one month and has driven 379,000 sq.ft. of cellular cofferdam sheeting, in addition to 160,000 sq.ft. of single-line sheeting. An elaborate and highly efficient construction plant and unusually dry weather in 1930 and in the first part of 1931 have materially aided the rapid progress of the work.

An important part of the construction plant was a wide steel bridge, 1,932 ft. long, on the downstream side of the dam. This bridge carried tracks for railroad cars and gantry travelers which distributed concrete and other materials to all parts of the structure. The bridge was similar to others formerly used by the same contractor to build long dams of moderate height. One of these applications of the steel construction bridge, at the Conowingo dam, was described in *Construction Methods*, September, 1928, p. 24. On the Conowingo job, the construction bridge was used to build only the long spillway and east abutment sections. At the Osage River project, the Stone & Webster Engineering Corporation designed the bridge to extend across the power house area, also, and to serve the construction of practically the entire dam and generating station.

Description of Project—The maximum height of the Osage River dam is 148 ft., from bedrock to the highway bridge which surmounts the structure. A curved east abutment section 331 ft. long connects with the headworks section, 511 ft. in length. The headworks section contains gate openings for eight main units and two service units. This section is located in the old river chan-

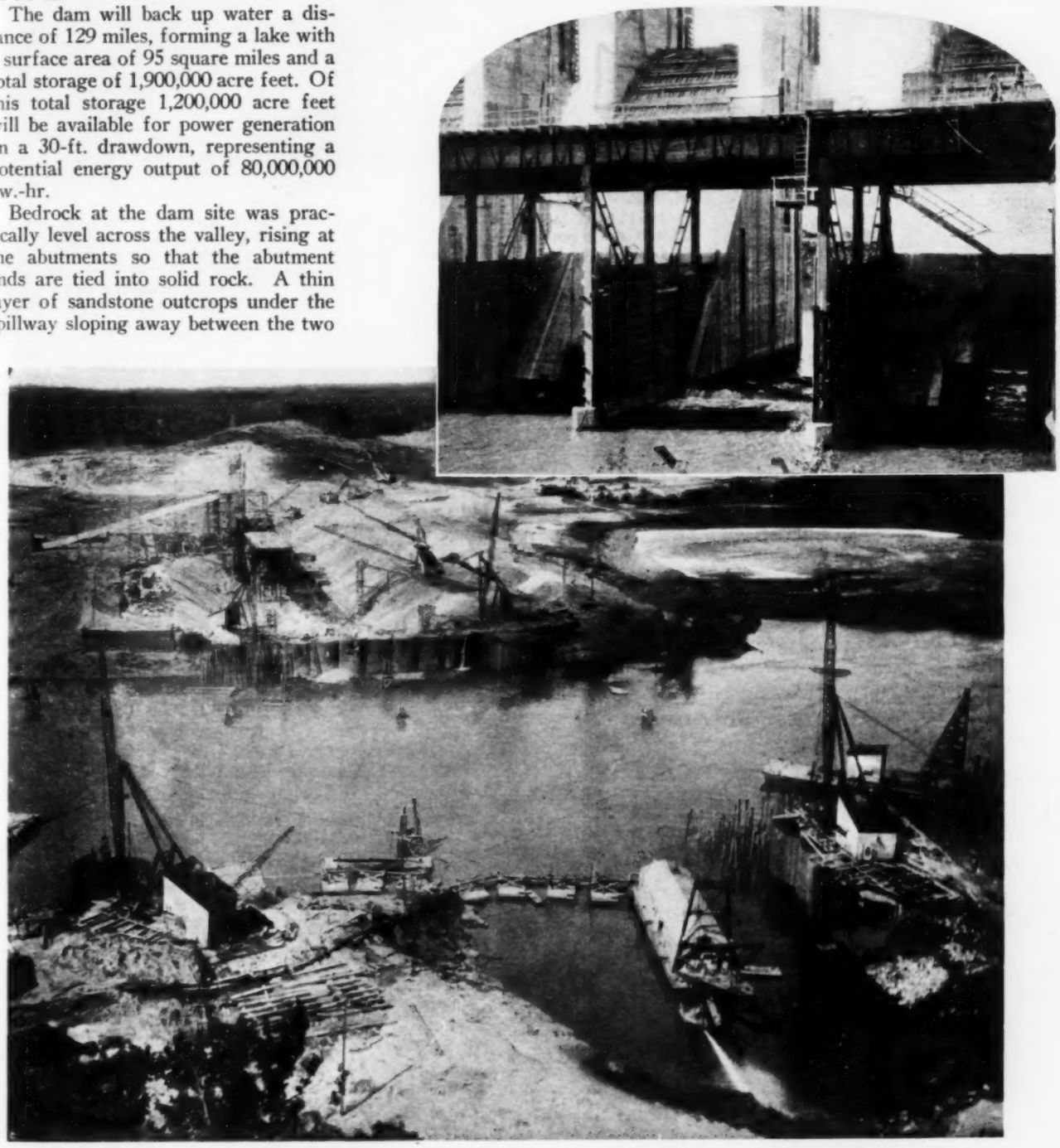
nel. Connecting with the headworks section on the west is the spillway section, 520 ft. long, of the ogee type. The spillway section is equipped with 12 tainter gates, 22 ft. high by 34 ft. wide. West of the spillway is a long, gravity-type non-overflow abutment, 1,181 ft. in length.

Only six of the eight main generating units are included in the present installation. When the ultimate installation of eight units has been completed, the plant will have a capacity of 268,000 hp. at the designed net head of 90 ft.

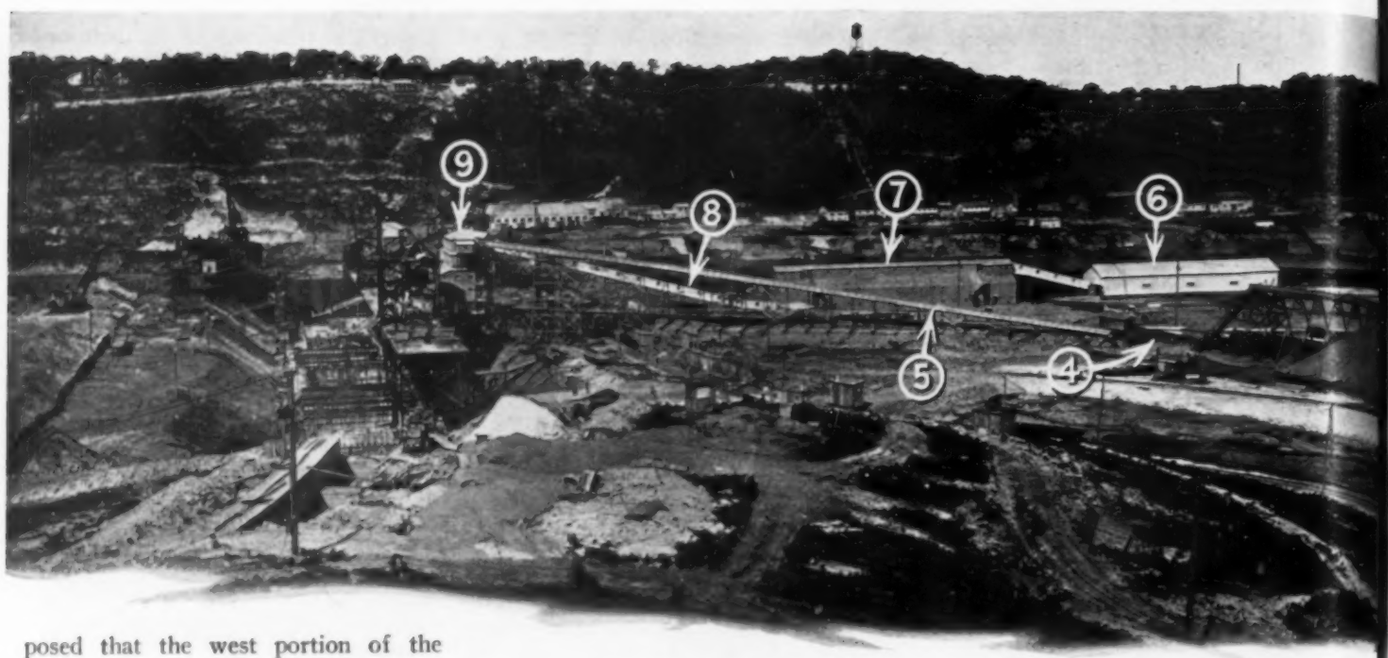
The dam will back up water a distance of 129 miles, forming a lake with a surface area of 95 square miles and a total storage of 1,900,000 acre feet. Of this total storage 1,200,000 acre feet will be available for power generation on a 30-ft. drawdown, representing a potential energy output of 80,000,000 kw.-hr.

Bedrock at the dam site was practically level across the valley, rising at the abutments so that the abutment ends are tied into solid rock. A thin layer of sandstone outcrops under the spillway sloping away between the two limestone formations under the west abutment and headworks sections. For the spillway foundation, the contractor excavated the thin top layer of limestone and the second layer of sandstone to place the structure on the underlying stratum of solid limestone. The power house and west abutment section were placed on the top layer of hard limestone, at a depth about 25 ft. below low water. A heel trench about 20 ft. wide and at least 4 ft. deep was cut in the bedrock under each structure. Grout holes were drilled on 5-ft. centers in two rows in the bottom of the trench, and these holes were grouted at 60- to 100-lb. pressure.

General Construction Plan — The first phase of the general construction plan comprised three operations: (1) Inclosing the west abutment and spillway sections in a cofferdam, (2) excavating the cover material to bedrock, (3) completing the abutment and spillway. Notches and sluiceways were left in the spillway section to pass the river during the second stage of construction. The original plan had pro-



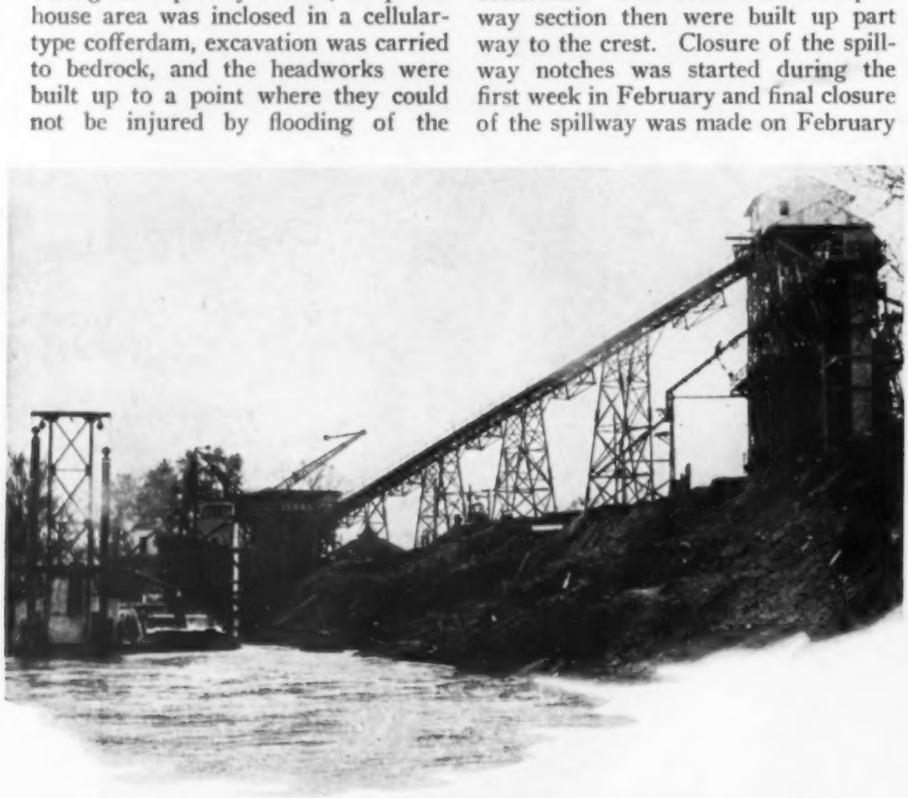
HAIRPIN COFFERDAM ***(on far side of river)***, **inclosing spillway and west abutment sections, consists of straight lines of steel sheet piling on upstream and downstream sides, with cellular wall at river end. Hydraulic dredge is excavating for east abutment; skid derricks are extending cellular walls of powerhouse cofferdam into river. SPILLWAY SECTION** ***(above)*** **contains notches and sluiceways which pass river after closing of powerhouse cofferdam. Steel bents of construction bridge are protected by completed blocks of spillway.**



MATERIAL-HANDLING PLANT. (1) Cars of 40-yd. capacity unload, six at a time, into track hoppers which discharge on to belt conveyor feeding inclined conveyor. (2) Inclined belt conveyor, 24 in. x 440 ft., elevates materials 45 ft. to shuttle conveyor on bridge over storage piles. (3) Shuttle conveyor, 24 in. x 330 ft., builds up live storage of 60,000 yd. under bridge 700 ft. long. Crane stocks additional 30,000 yd. dead storage. (4) Reclaiming 30-in. belt conveyor, about 850 ft. long, in tunnel under stock piles, feeds inclined belt conveyor (5), 30 in. x 487 ft., which raises aggregates to bins of mixing plant (9). Cement, received in bulk, is unloaded from cars in shed (6), where hoppers with adjustable gates feed belt conveyor at constant rate. Belt delivers to 14-in. screw conveyor 166 ft. long in cupola (7) of 15,000-bbl. storage shed, from which inclined belt conveyor, 20 in. x 450 ft., carries cement to mixing plant.

posed that the west portion of the abutment be cut off with a transverse line of sheet piling across the cofferdam. It was intended that this portion should be concreted after the river had been diverted through the spillway. Concreting of the entire area inside the cofferdam proceeded so rapidly, however, that the transverse cut-off wall was not needed.

After the river had been diverted through the spillway section, the power house area was inclosed in a cellular-type cofferdam, excavation was carried to bedrock, and the headworks were built up to a point where they could not be injured by flooding of the cofferdam. The notches in the spillway section then were built up part way to the crest. Closure of the spillway notches was started during the first week in February and final closure of the spillway was made on February 19, restricting the entire flow of the river except for the flow through a 48-in. diameter passage in the spillway section.

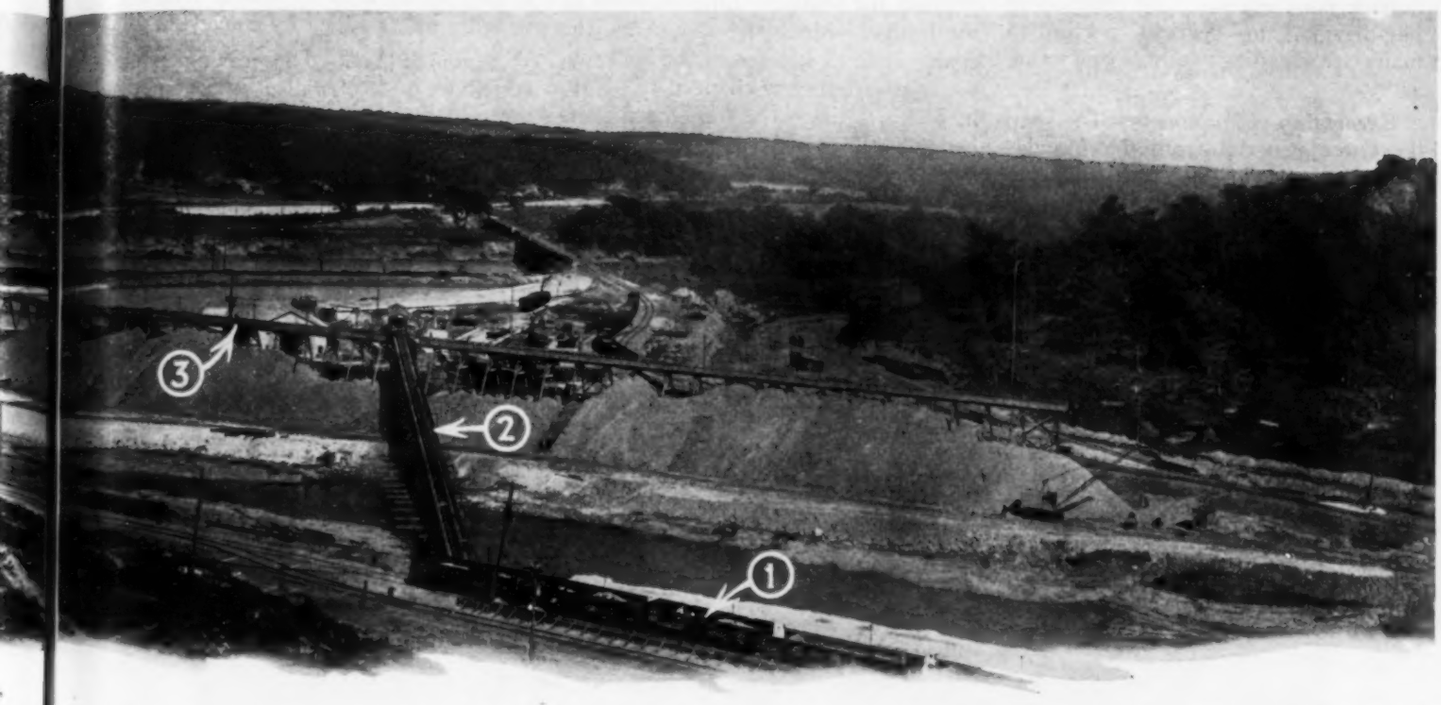


SAND AND GRAVEL PLANT about 3 miles below dam supplies over 75 per cent of gravel and about 40 per cent of sand required for concrete. Diesel 15-in. suction dredge, on hull made up of eight steel pontoons bolted together, pumps into steel barges. Stiff-leg derrick, operating 2¼-yd. clamshell bucket, lifts material from barges to hopper feeding belt which elevates to top of screening and crushing plant. Equipped for dual operation and designed for capacity of 200 yd. an hour, plant exceeds this rate of production.

Cofferdams — Flow records of the Osage River range from a maximum of 110,000 sec.-ft. to a minimum of 324 sec.-ft. with an average of 10,500 sec.-ft. The power-house cofferdam was designed to top a flood of 90,000 sec.-ft.

Bedrock under the river was about 25 ft. below low water, and the rock was covered with 15 to 25 ft. of gravel. Neither crib nor earth-fill cofferdams, with steel sheet-pile cut-off walls, would have been practical or satisfactory on this kind of river bed. Cofferdams of these types would be lacking in stability and watertightness. The cellular-type of steel sheet-pile cofferdams was the logical design to meet the condition. After investigation of the economy of various cellular cofferdam plans, the design used was finally adopted.

To inclose the abutment and spillway section west of the river channel, the engineers designed a hairpin coffer, with straight lines of steel sheet piling on the upstream and downstream sides, and with a stable, cellular wall forming the closed end, at the river's edge. After work on the spillway section had progressed to sufficient height, the power-house area was inclosed by a

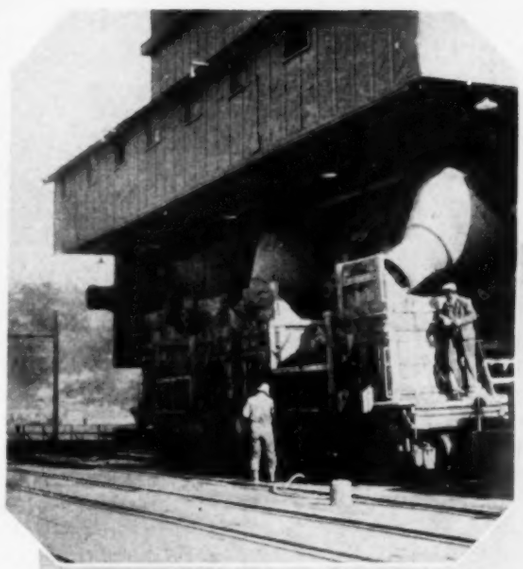


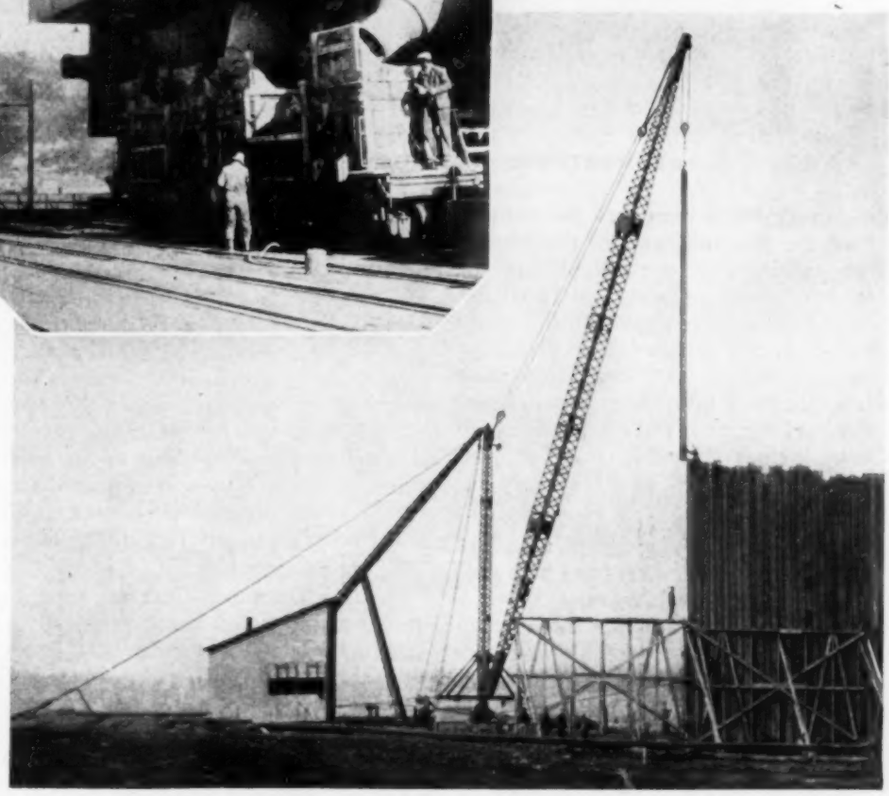
cellular-type cofferdam, tying into the spillway concrete. An advantage of the cellular-type was that excavation inside the cofferdam could be carried up to the wall, no sloping banks or other bracing being necessary.

Steel piles up to 60 ft. in length were used in the cellular cofferdams. Circular cells were out of the question, because a diameter sufficient for stability would have produced excessive tension in the joints. The cofferdam walls, therefore, were designed with inside and outside lines tied together by transverse lines at as frequent intervals as necessary to keep maximum joint tension, figured about 6 ft. above the bottom of the excavation, from exceeding the allowable limit of 6,000 lb. per linear inch. These straight transverse lines of sheet piling were the dividing walls between the cells. The lines of sheet piling forming the sides of the cofferdam walls were scalloped in plan, with the curved ends of each cell being driven on circular arcs. Six-cell units, with longitudinal and transverse internal walls, were placed at points where it was necessary to have sections which were stable in themselves.

To take advantage of the cantilever strength of the steel-sheet piles, the engineers designed the exterior walls of the cofferdam 5 ft. higher than the interior walls. On the upstream side of the power house cofferdam, the contractor drove 60-ft. piles in the exterior walls and 55-ft. piles in the interior. On the downstream side, the outside piles were 55 ft. long and the inside piles 50 ft. long. The upstream wall had a maximum thickness of 50 ft. 1½ in.; the downstream wall was 48 ft. 7 in. across the broadest part.

Six skid derricks, equipped with swinging heads and No. 1 National steam hammers, drove practically the entire quantity of 540,000 sq.ft. of Carnegie steel sheet piling. Steam-driven American steel stiff-leg derricks of 10-ton rated capacity, with 100-ft. booms were mounted on steel sleds which could be skidded about the job by the





STEEL SKID DERRICK sets straight line sheeting between portable templets. Derrick has stiff legs brought close together for mounting on skids. Note guys from top of mast to provide stability for swinging boom to side. **FOUR TILTING 2-YD. MIXERS** ***(above)*** discharge, two at a time, into hoppers on flat car.

derrick hoist engines. In addition to pile-driving, the derricks performed many excavating and concreting services.

Excavating Equipment — To strip the cover material from the foundation rock and to open the diversion channel, the contractor had two large draglines and two suction dredges. The smaller suction dredge, diesel-powered, with 10-in. discharge, operated under sub-contract. In addition to the earlier operations, carried on by both dredges, the larger, 16-in., electric dredge later excavated the tailrace. Both the draglines were of the Monighan walking type, one of 6-yd. and the other of 3-yd. capacity. Material excavated from the west cofferdam and the diversion channel was placed in the construction plant area downstream from the dam on the west bank, raising the level of filled land above the maximum high water elevation. Total excavation amounted to 847,500 yd. of earth and 73,250 yd. of rock.

Construction Bridge — A most important factor in making the high concrete-placing records was the construction bridge, which carried three standard-gage railroad tracks allowing continuous, flexible delivery of concrete from the mixing plant to all parts of the dam. As shown by the cross-section of the bridge, the rails of a 40-ft. gage track for the gantry travelers were laid above the outside stringers. The bridge deck was supported by three-post bents, with varying spans between the bents on different parts of the bridge. Along the abutments, the spans were 45 ft.; across the spillway, the span length was changed to 45 ft., in order to place the three-post bents behind the completed blocks of the dam, clear of the flowing water. In the power house area, the contractor used a span length of 55 ft., which located the posts between the units, where they could be left undisturbed during the entire construction of the power station. The lower portions of the posts on the upstream side of the bridge were buried in concrete, and were burned off when the bridge was dismantled.

Gantry Travelers—Three Insley self-propelled gantries, 45 ft. high, traveled on the bridge. The gantries were equipped with Insley 100-ft. towers for distributing concrete and with American 10-ton stiff-leg derricks having 80-ft. booms for handling forms and other material. From its top position on the tower, the concrete hopper could chute concrete to any part of the highway bridge.

Material Storage—Concrete production was protected against failure of aggregate supply by a live storage of 60,000 yd. and a dead storage of 30,000 yd. An extensive belt conveyor system was employed to store and reclaim the aggregates. Sand and gravel from the job plant and from outside sources were received in 40-yd. railroad cars which dumped into track hoppers having an unloading capacity of 600 to 650 yd. an hour. Cement, received in bulk, was handled by conveyors.

Mixing Plant — The mixing plant rested on a steel-walled island along the construction bridge inside the west cofferdam. To make a solid foundation for the plant at this convenient location, the contractor drove steel sheet piles in the form of a stable six-cell unit and hammered down wood piles inside the cells. The plant rested on the wood piles. It was possible to excavate all around the plant without disturbing its foundation.

POWER-HOUSE COFFERDAM consists of cellular walls connecting into spillway concrete.

Concrete materials moved by gravity from the bins at the top of the plant to the measuring batchers and then to the four 2-yd. Smith tilting mixers, which delivered the concrete to railroad cars on the bridge. Cement and gravel were weighed in Johnson batchers and sand was measured in a Johnson inundation tank. An interlocking device on each mixer insured a full 2-min. mix after the batched materials had entered the drum.

Flat cars on the bridge carried four 2-yd. hoppers, which took the discharge of the four mixers. The hoppers were so spaced that two mixers could be discharged at a time. The mixers operated in conformity with this arrangement, the time cycle of one pair being slightly behind that of the other. A Vulcan gasoline dinkey pulled each flat car.

Practically all concrete was placed by chute from the bridge. Hoppers along the edge of the bridge, level with

STARTING ERECTION OF CONSTRUCTION BRIDGE inside west cofferdam. Concrete pedestals ready for bridge posts. Large walking draglines are excavating in background.

the deck, delivered concrete to the lower portions of the structures. Concrete for the upper portions was elevated by the towers attached to the traveling gantries.

Concrete-Placing Records — During the month of June, the contractor made the remarkable concrete-placing record of 113,000 yd. To make this record, it was necessary to mix and place an 8-yd. batch every 2 min., 30 sec. The maximum quantity placed in one day in June was 5,070 yd. During this month, the mixers started turning at 3:30 p.m. each Sunday and ran continuously until 5 p.m. Saturday.

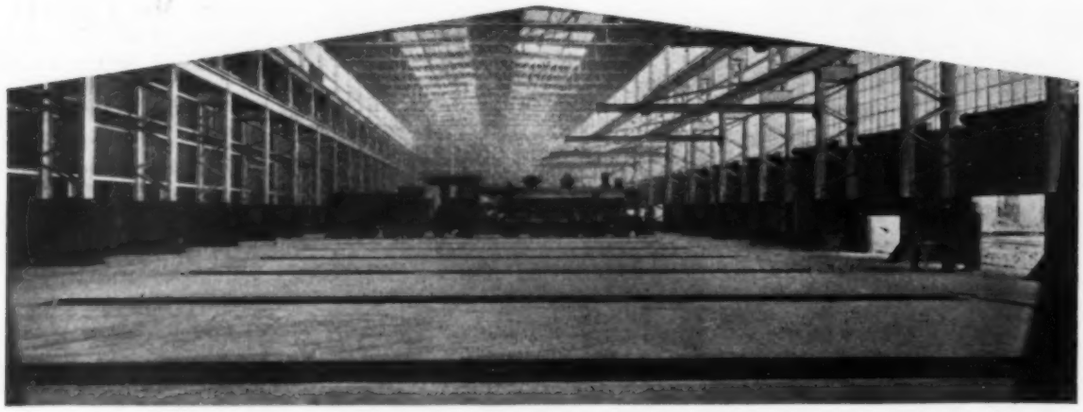
Between May 1 and Oct. 1, the contractor placed 400,000 yd. of the total of 550,000 yd. in the structures. One of the daily records for September, 5,082 yd., exceeded the best day in June. In the 5-month period from May 1 to Oct. 1, the work was carried on by two shifts, 11 hours in the day and 9 hours in the night, with the exception of 4 weeks in June and 10 days in September, when three 8-hour shifts were employed.

Additional Construction Plant—One of the photographs indicates the principal features of the sand and gravel plant. A temporary steam power plant, equipped with oil-fired boilers of 1,313-hp. capacity (designed to operate at 200 per cent rating) and two 3,000-kw. steam turbine units having Westinghouse-Leblanc jet condensers, supplied power to all fixed equipment on the job, to the electric dredge, to the gravel plant and for camp light and power. One of the turbo-generators served as a spare. The camp, airport and construction railroad were well equipped and efficiently managed.

Administration — Louis H. Egan, president and A. L. Snyder, general manager of the Osage Project, have been in executive charge for the Union Electric Light and Power Co.

All construction has been under the general direction of A. W. Clark as works manager, with H. F. Anthony as general superintendent for the dam, power house and reservoir work, G. P. Jessup as general superintendent for the dam and power house, O. Davidson as superintendent of the reservoir work, H. C. LaVille as assistant works manager at Bagnell, and F. C. Dana as general superintendent of transmission line construction.

OSAGE HYDRO-ELECTRIC DEVELOPMENT six days after final closure of sluiceways. Only superstructure on power station is narrow bay, between headworks and generating units, which houses switching and control apparatus. Metal cover over each generating unit can be raised to permit making all repairs to rotors or stators under cover.



ASPHALT SURFACING applied to floor of locomotive shed of New Zealand Railways.

ASPHALT FLOORS

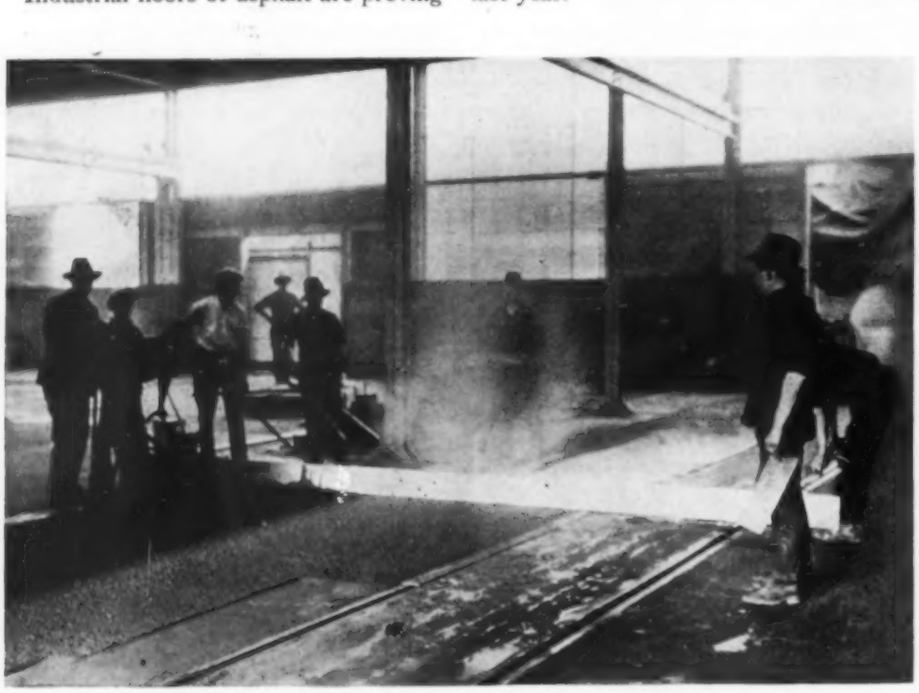
for Industrial Buildings Provide "Off-Season" Work for Paving Contractors

ASPHALT contractors in New Zealand, during the "off-season" period which extends throughout the winter months, are able to keep their construction crews at work and their hot-mix plants in operation because of a growing demand in that country for asphalt floors in factory buildings, docks, piers, warehouses, railroad round-houses, freight sheds and various other structures. Industrial floors of asphalt are proving successful in New Zealand, according to reports received by the Asphalt Institute, New York.

"In looking for 'off-season' work for our hot-mix plants," writes A. Donald Paterson, of British Pavements, Ltd., Wellington, New Zealand, "we have been fortunate in obtaining flooring contracts under cover, particularly with New Zealand Railways, for which we completed 50,000 sq.yd. last year."

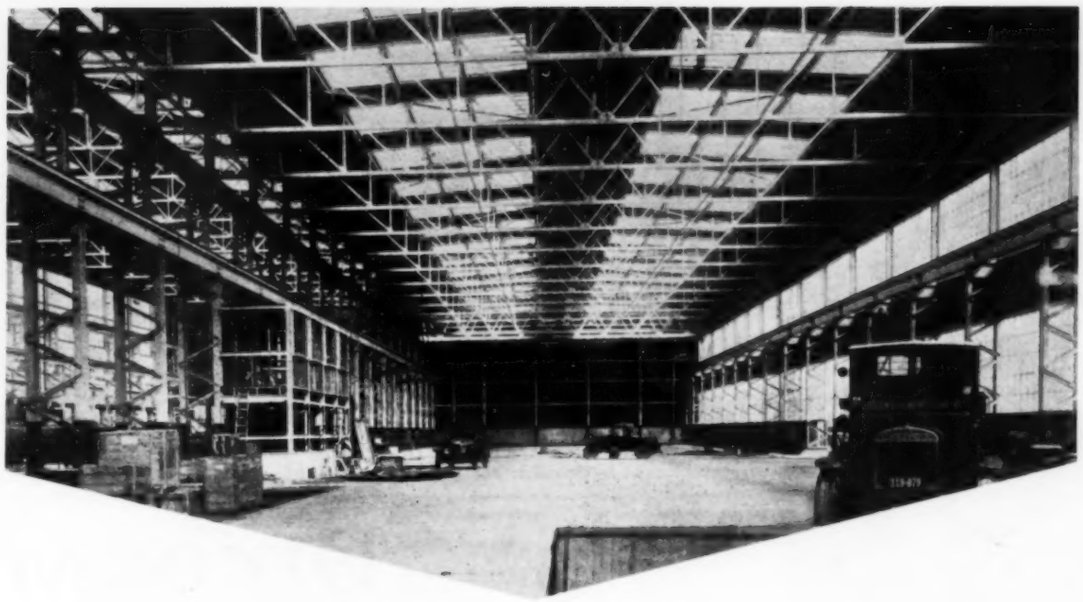
Method of Laying—Describing the construction methods used in laying the flooring Mr. Paterson writes: "The asphalt surfacing specified was 1 in. compacted, on a 5-in. Portland cement concrete base. The design had to take care of heavy weights, while standing, as well as iron wheels. Mastic was undesirable, owing to the excess of bitumen contained therein.

"The asphaltic cement used was an 8.9 per cent, 40 penetration Mexphalt,



SCREED for leveling the hot asphalt mix rides on ¼x4-in. steel plates laid on timbers spaced 12 to 18 ft. apart.

ROLLER weighing 1½ tons compacts the hot mixture, leaving joints that seldom require "ironing."



WORKSHOP at Dunedin, for New Zealand Railways, has floor area of 8,000 sq.yd. paved with asphalt.

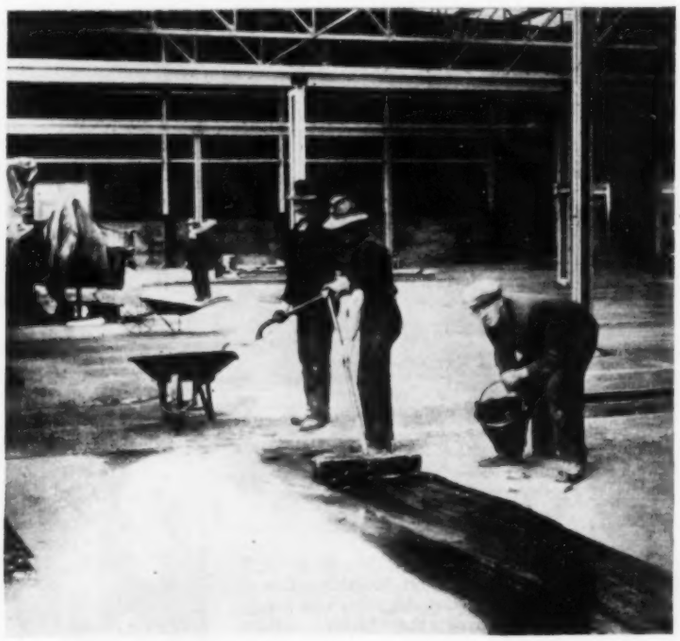
supplied by the Shell Co. of New Zealand. The method of mixing and delivering to the job was in accordance with standard specifications. When the concrete base had cured, it was painted with a cut-back asphalt mixed with benzoline or high grade petrol, applied thinly with a fine-hair broom over the entire surface. Timbers, 4 x 1 in. in size, then were spaced from 12 to 18 ft. apart. Between these timber bays the asphalt, at 350 deg. F., was placed hard against a finishing board resting on ½ x 4-in. iron bars placed on the 4 x 1-in. timbers. The mix was well packed against this board. The latter was moved, in the manner of a cross-cut saw, to and fro and with a forward motion.

Equipment Used — "This finishing board is designed with a steel inset face. Generally, it is warmed first in the mix. Occasionally if the board drags over a stone or lump it is taken back a yard, more mix is scattered in front of the board and the surface again lightly screeded. From 1,000 to 1,500 yd. per day can be laid with a small gang. Care is taken as the iron is moved forward on the 4 x 1-in. timbers to get the joints even.

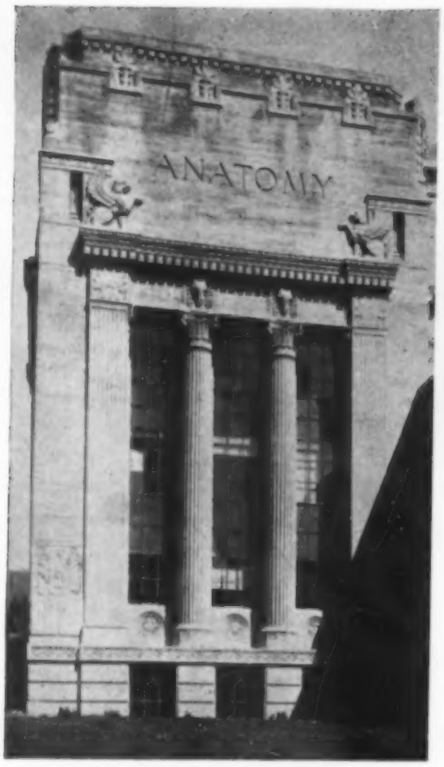
"Immediately following the finisher comes a 1½-ton power roller which compacts the mixture. The driver becomes so expert that the joints seldom require ironing. However, a man follows up the rolling and trowels any defects while the pavement is warm. It is necessary to have a minimum of about ten men engaged in laying the mix. Experienced hands are essential for doing the work properly.

"The roller must hit the mix at the right temperature in order to give the greatest compactness. Ample water should be used on the roller wheels. We have found a wet sack on the front wheels to be effective. The surface is swept with Portland cement or filler. Some of these floors have been down for years and have given excellent results."

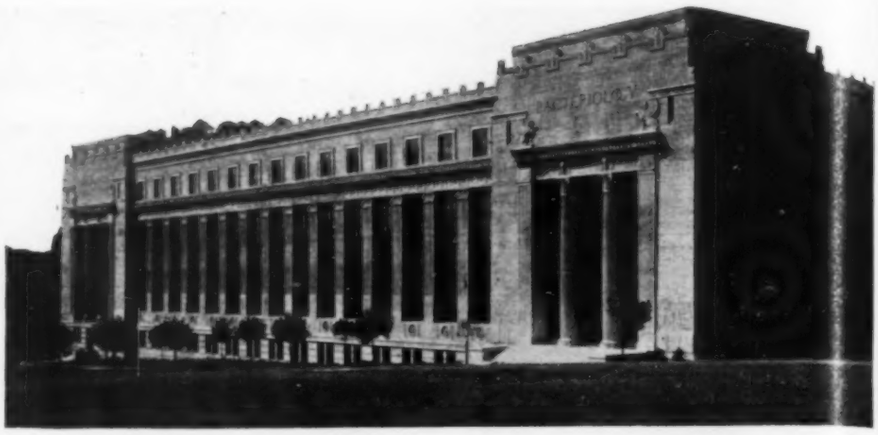
AROUND COLUMNS where power roller cannot always operate, finishing is done with hand roller.



FLOATING BITUMEN with squeegee is a special form of construction not employed on standard flooring.



ALL ORNAMENTAL WORK on Life Science Building, California, including columns and pilasters, is of concrete, cast in place.



ALL-CONCRETE CONSTRUCTION produces decorative effects on Life Science Building for University of California; George W. Kelhan, architect.

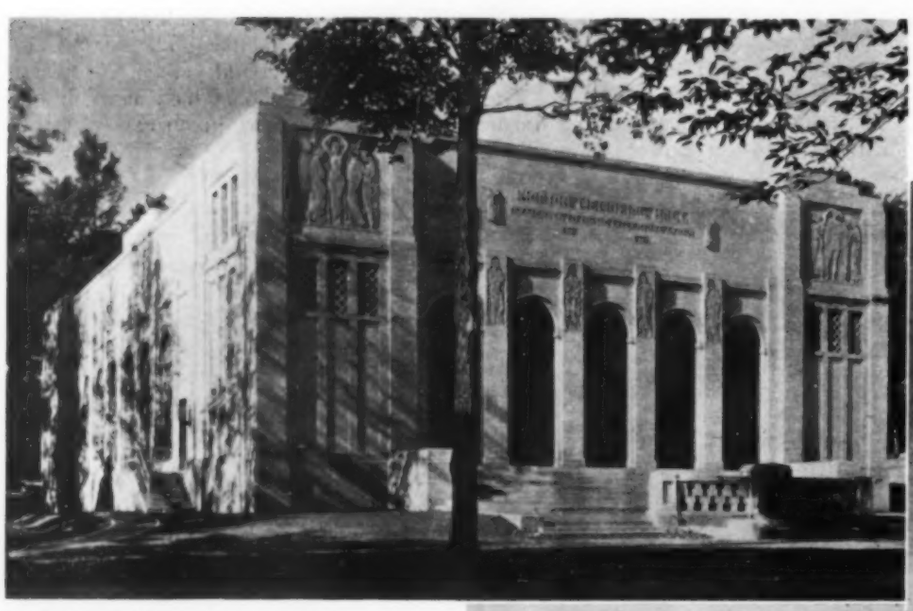
DECORATIVE

in Monolithic Concrete

BY THE use of specially lined wood forms and waste molds of plaster of Paris in building construction, it is possible to obtain a great variety of decorative effects with monolithic concrete cast in place. Typical examples of the results in ornamentation that can be obtained with the same structural concrete that enters into the columns, floors and walls of buildings are illustrated herewith.

To procure a smooth surface finish it is common practice to insert a non-warping fiber board lining against the outer faces of wooden wall forms. This method of treatment was employed on the Lions Building, in Los Angeles, illustrated on p. 48. After the lining was placed the corners were rubbed down with sand paper and the surface coated with a thin film of form oil.

Beveled or fluted effects are easily

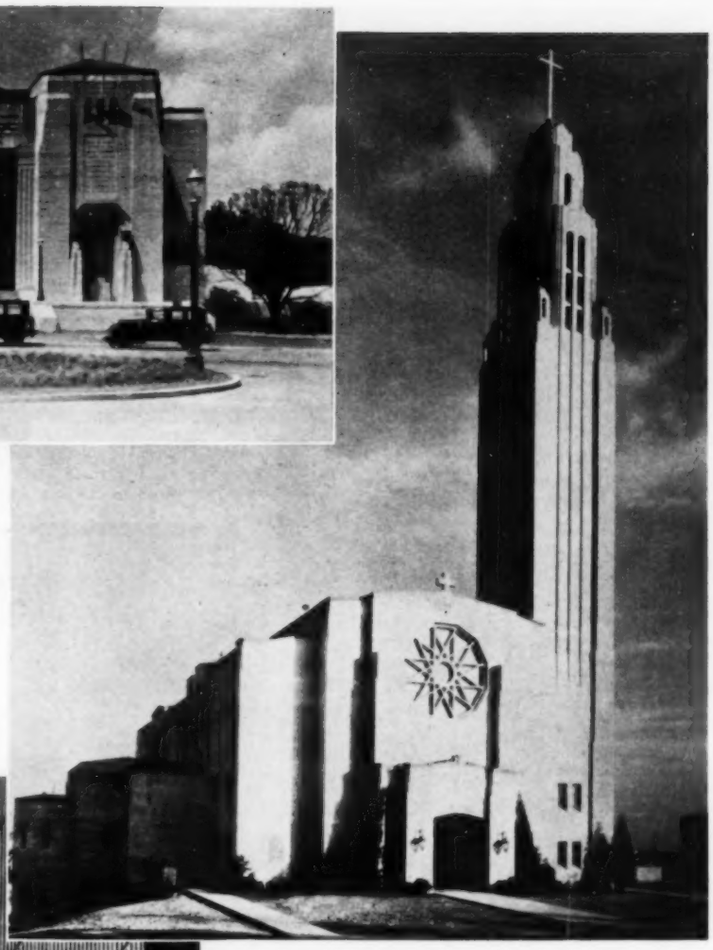


WASTE MOLDS were used to produce ornamental panels in concrete at Norton Memorial, Chautauqua, N. Y. O. F. Johnson, architect.

SMOOTH, EVEN SURFACE TEXTURE on Wilshire Tower *(right)*, Los Angeles, was result of lining the forms against which concrete was cast. G. S. Underwood, architect.

MONOLITHIC THROUGHOUT. Westchester County Building, White Plains, N. Y., is constructed of concrete from designs of Walker & Gillette.

TREATMENT
Building Construction



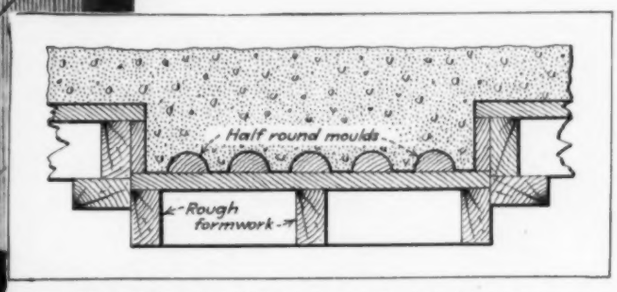
ECCLESIASTICAL USE of monolithic concrete is exemplified by St. Joseph's Church, Seattle, Wash. A. H. Albertson, architect.

SURFACE FLUTING for Chouinard School of Art, Los Angeles, was produced by lining face forms with the top halves of half-round sticks, giving effect of shallow arris. White strips are ¾-in. recesses filled with white cement plaster.

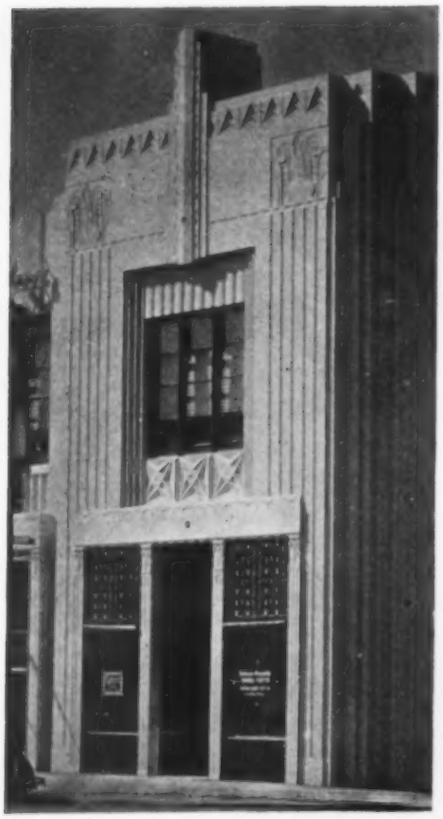
obtained by the use of vertical wood strips in the forms. Half-rounds may be employed as shown in the sketch at the bottom of this page. To obtain true surfaces it is desirable to fill all butt joints between strips with putty.

On the walls of the Chouinard School of Art building, illustrated on this page, the wide white vertical stripes above the doorway were produced by forming ¾-in. recesses in the wall and later filling them with white cement plaster.

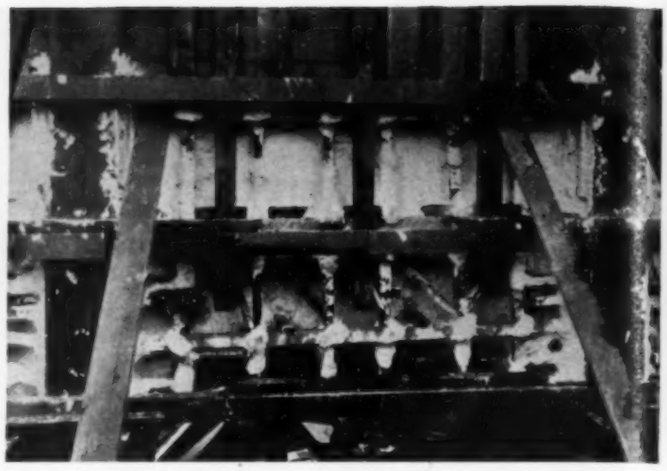
In the making of reversed wood molds, sharp edges or corners should



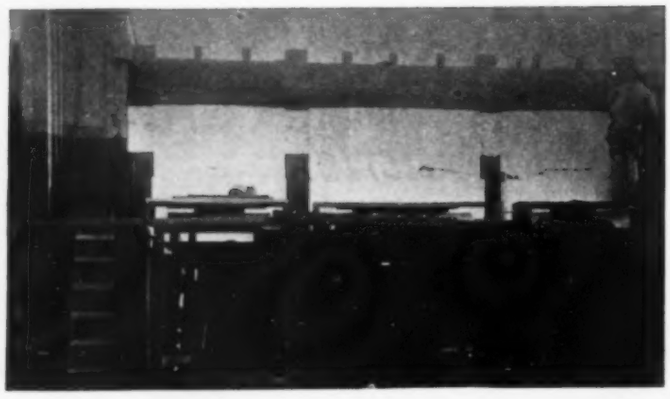
FORM DETAIL showing how fluted effect is secured by use of half-rounds on inside of forms.



FIBER-BOARD LININGS on forms produced flat surfaces on Lions Building, Los Angeles. Vertical strips gave unusual effects. All ornament made from plaster of Paris waste molds.



WASTE MOLD *(right)* of plaster of Paris built into wood forms for Lions Building. Rigidity produced by bracing and iron pipe reinforcement. Framing of wood forms about molds is sufficient to remove any excessive load on molds.



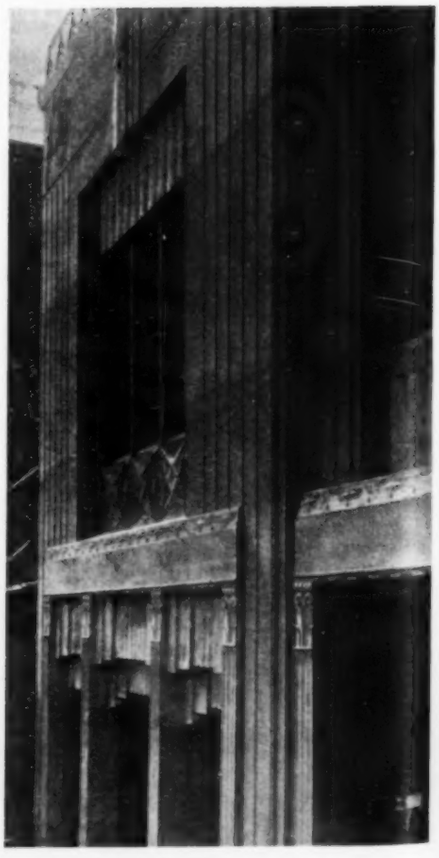
REVERSE SIDE *(left)* of waste molds over entrance to Lions Building, showing pilaster caps and treatment of decoration below spandrel beam.

be sanded off to a slightly round shape. Care should be taken to avoid undercuts that make it impossible to draw the forms. Molded concrete surfaces should pitch slightly outward and downward to provide drainage and protection for the ornament.

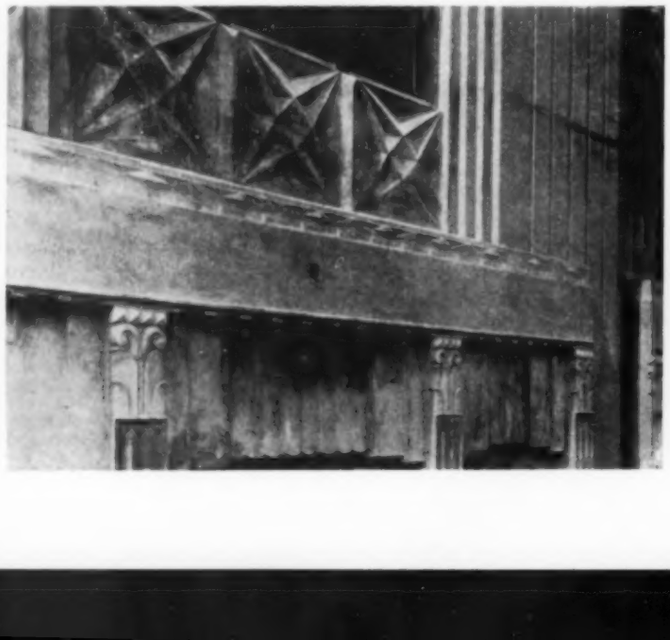
Waste molds of plaster of Paris should be of sufficient thickness and well reinforced with hemp and small pipe to resist the pressure of concrete placed against them. The face of the mold is well shellacked before being assembled in the forms.

During the actual pouring of concrete the faces of waste molds should be covered with canvas to protect them from splash and disfiguration. When the concrete in the form has risen well above the center of the mold, the canvas should be gradually withdrawn as additional concrete is poured. The concreting operation should be continuous, and the raising of the canvas done slowly until the mold is filled. Spading of the concrete must be done carefully and away from the face of the mold. Excessive spading should be avoided.

All waste molds, whether of wood or plaster of Paris, should remain in place until the structure is practically completed, thus protecting the ornament from damage during construction.



DRAPERY EFFECT in monolithic concrete over entrance to Lions Building achieved by plaster of Paris waste molds.



CLOSE-UP OF ENTRANCE to Lions Building, showing decorative effects obtained with monolithic concrete after waste molds had been stripped. Shadow lines at right made by building a 2x6, a 2x4 and a 2x2 into corner of form.

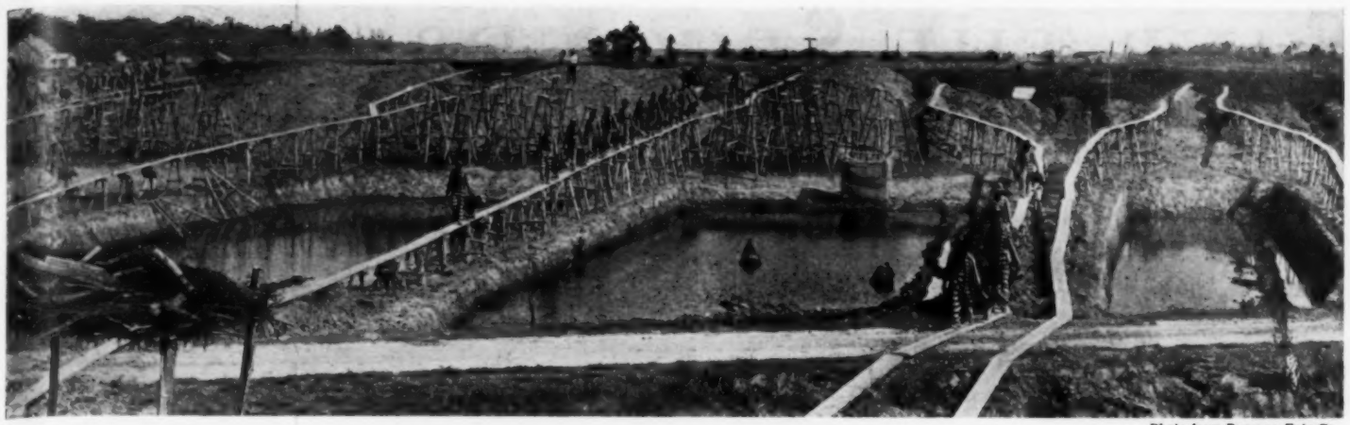
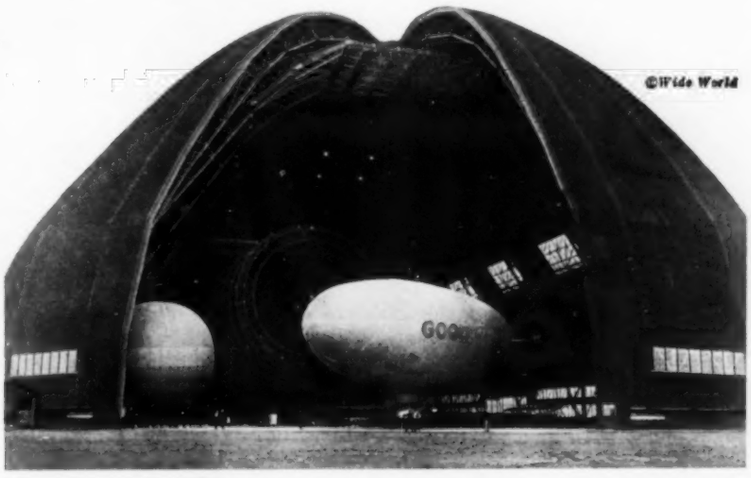


Photo from Bucyrus-Erie Co.

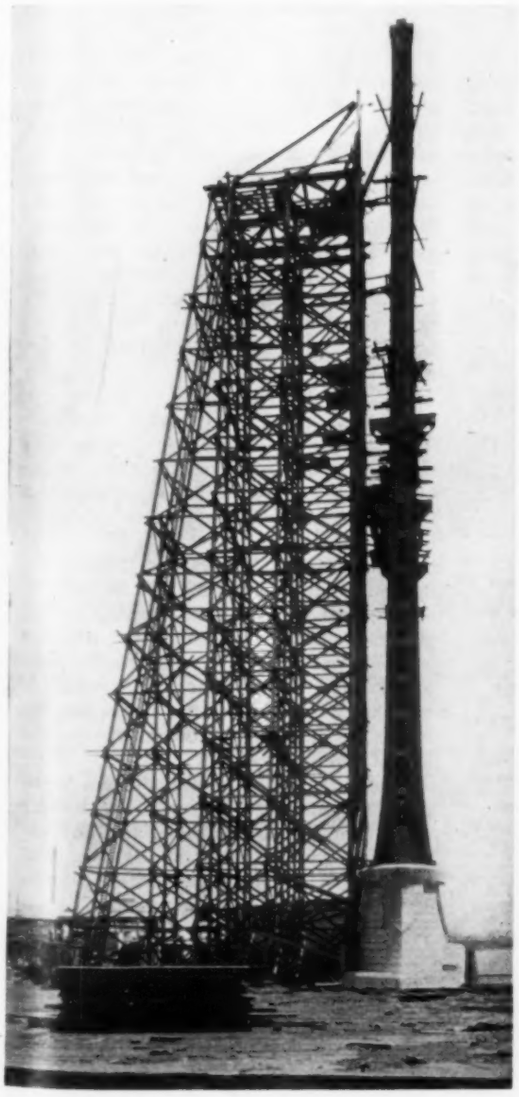
OBSOLETE METHODS OF LEVEE BUILDING on the Mississippi River. Thirty years ago negro convicts wheeled earth to place along plank runways—a slow process compared with modern machine methods.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction



UNIQUE DOORWAYS, propelled electrically on tracks, give access to Goodyear-Zeppelin airship dock and factory at Akron, Ohio.



LOFTY WOOD SCAFFOLD, reaching to height of 350 ft., is erected to set steel for cableway towers of St. Johns suspension bridge across Willamette River at Portland, Ore.

EXPENSIVE MODELS. For exhibit purposes American Tractor Equipment Co. and Caterpillar Tractor Co. spend $3,000 on toy-size reproduction, complete in all details, of hydraulic earth-mover and "60" tractor.

SAVE THE SECONDS

— and the Profits on Batch Haulage Will Take Care of Themselves

Part I

ANDREW P. ANDERSON

Highway Engineer, U. S. Bureau of Public Roads, Reports Analysis of Stop Watch Studies to Check Costly Time Losses

CAREFUL studies of production on more than 100 concrete paving projects throughout the United States show that an average of 17 per cent of the time during which the construction crew is out on the road ready to work is actually lost because of insufficient supply and faulty operation of the truck hauling equipment.

This is one of the significant findings contained in a recent report by Andrew P. Anderson, highway engineer, Division of Management, U. S. Bureau of Public Roads, under whose direction have been analyzed accumulated field records of paving production during the last three years. The following notes are from Mr. Anderson's report:

On short hauls the main factor in determining how many batches any given truck can deliver per hour is not primarily the road speed but the length of time the truck must spend in the yard and at the mixer during each trip. Given equal road speeds and present normal operating conditions, a two- three- or four-batch truck does not deliver to the mixer as many batches per hour as two, three, or four 1-batch trucks, respectively. It was found that on 122 concrete paving jobs on which trucks were used for batch hauling, the average length of haul was 2.65 miles. The relative production efficiency of single-batch and multiple-batch trucks, therefore, is one important factor which should be given full consideration in the selection of equipment for a given job.

The present common practice of subletting the hauling of the materials on a batch-mile, square-yard, or other similar basis introduces interests which are often antagonistic instead of mutual, in that the largest possible profit from the hauling will be secured when the rate of production is held at a point at which the profits from mixing and placing the batches are actually considerably below their possible maximum.

The main causes that curtail production on a concrete paving contract are (1) less-than-capacity loads on the key equipment; and (2) operation of key equipment at less than its maximum rate, due to interruptions and delays—"time losses." In his report Mr. Anderson divides these time losses into two classes: (1) Major delays of 15 min. or more which, as shown in Table 1, cause a loss of 40 per cent of the total available time; (2) minor delays of less than 15 min., which cause a loss of 15.6 per cent of the total working time, as shown in Table 2, or 26 per cent of the net working time remaining after deducting major time losses of 15 min. or more.

Hauling equipment, according to Table 2, is responsible for 12.2 per cent of the minor losses in net working time or 7.3 per cent loss of the total working time. Causes of these minor time losses chargeable to hauling equipment, rated on a percentage basis, are: Shortage of trucks, 19 per cent; dumping batches, 17 per cent; faulty or inefficient truck operation, 64 per cent.

From Table 1 it is seen that of the total available time lost by major delays 3 per cent was due to hauling equipment. These losses occurred while the full crew were on the job and might better be included under net working time losses. On this basis losses due to hauling equipment amount to about 17 per cent of the net working time, or 10 per cent of the total available time.

TABLE 1.—*Major delays—Per cent of total available time lost by mixer in stops of 15 min. or more*

Cause of delay	Per cent of available time lost
Rain and wet subgrade	17.5
Moving plant set-up	3.5
Lack of materials	3.5
Lack of prepared subgrade	3.0
Inadequate supply and faulty operation of hauling equipment	3.0
Mixer trouble	2.0
Lack of water at mixer	2.0
Loading plant trouble	1.5
Miscellaneous causes	4.0
Total	40.0

TABLE 2.—*Minor delays—Average time lost to mixer for interruptions of less than 15 minutes, expressed in percentage of net working time (total available time minus all time losses of 15 minutes or more)*

Cause of delay	Per cent of net working time lost	Per cent o total working time lost
Hauling equipment, supply	2.3	1.4
Hauling equipment, operation	7.9	4.7
Hauling equipment, dumping	2.0	1.2
Lack or trouble with water at mixer	3.2	1.9
Subgrade delays	2.7	1.6
Mixer operator	2.1	1.3
Mixer trouble	1.9	1.1
Lack of materials and supplies in place	1.1	0.7
Finishing	0.7	0.4
Miscellaneous	2.1	1.3
Total	26.0	15.6

The process of constructing a concrete pavement is essentially a continuing operation in which the maximum rate of production is fixed by the requirements which determine the length of the mixer cycle. Losses of time occasioned by lack of coordination between the various operations involved in the paving process are irretrievable. Not even the loss of a single batch from the given maximum rate during one hour can be made up by more rapid operation during the next hour or the next day. If, for example, the mixer cycle is 75 sec., the maximum possible rate is 48 batches per hour; and a production of, say, 45 batches during one hour can not be made good by a production of 51 batches during the next hour. A batch lost is a batch lost beyond recall.

The average hourly cost of operating a modern concrete paving plant, exclusive of materials and hauling, is seldom less than $40 or $45 for every hour the paving crew is out on the road. If, for example, the mixing time and operating requirements permit a mixer cycle of 75 sec. and the hourly operating cost is $40.80, the operating cost per batch will be only 85 cents when the outfit is working at 100 per cent efficiency, and this cost will rise to $1.70 per batch when production falls to 24 batches per hour. This example emphasizes the importance of keeping the mixer in continuous operation on the lowest possible cycle.

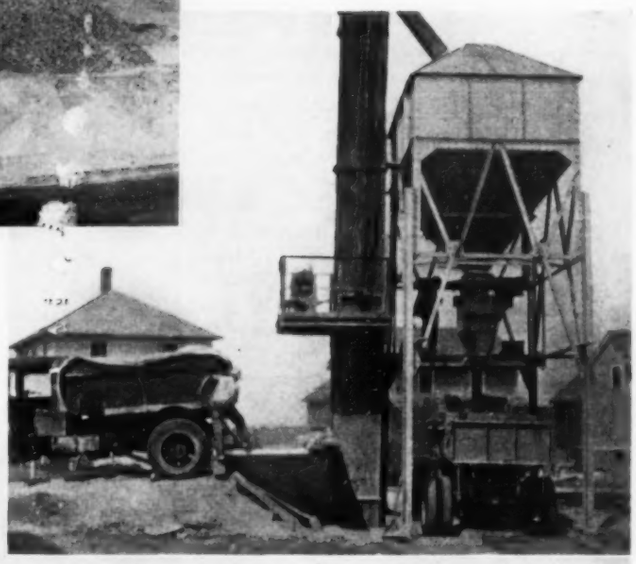
Under the usual field conditions, however, neither the mixer nor the hauling equipment can be operated for any extended period of time at 100 per cent efficiency. A large number of causes seem to conspire to prevent perfectly coordinated operation.

HAULING OPERATIONS ANALYZED

For the purpose of giving the reader a better understanding of the reasons for those large, persistent, and expensive losses which are due to the hauling equipment an analysis will be made of the operating conditions of the hauling equipment: Truck operation may be subdivided

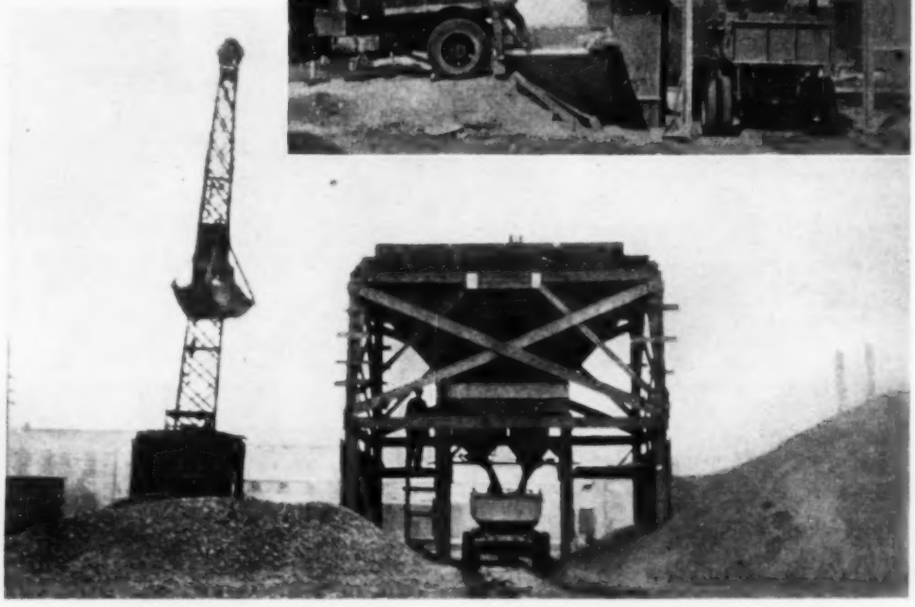
Efficient Truck Operation Begins With the Layout of the MATERIAL YARD

PLANNED FOR SPEEDY LOADING *(above)*. At this batching plant, trucks, with through runway under bins, were regularly loaded with three batches of sand, two sizes of aggregates and cement in less than 75 sec.

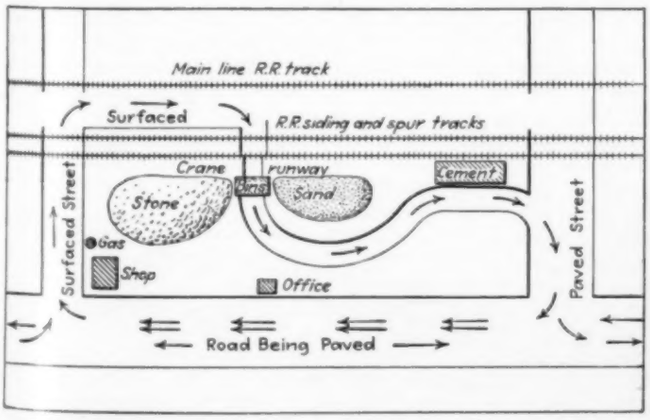


BULK HANDLING OF CEMENT *(right)* at modern plant cuts time of material handling operations.

STRAIGHT DRIVEWAY extends under two separate aggregate bins. No backing or turning of trucks during loading.



TWO-COMPARTMENT BATCHER, with driveway under aggregate loading bins, minimizes standing time of motor truck receiving batches by gravity flow. Bins are replenished from stock piles by clamshell bucket on crawler crane.



GOOD YARD LAYOUT. Trucks drive straight under loading bins served by railroad siding, pass direct to nearby cement storage shed and loading platform and then proceed on easy curve to main road.

WHERE TIME IS WASTED. Separate bins are set up for two sizes of aggregate. No through drive for trucks, which must maneuver and back up for each loading.

TABLE 3.—*Average truck time constant on all concrete paving jobs*

Operation or item	—Time consumed, in seconds— 1-batch truck	2-batch truck	3-batch truck	4-batch truck
Batcher plant:				
Loading sand and stone or gravel	15	59	114	190
Loading cement	28	80	106	110
Driving and maneuvering within yard	81	99	102	100
Mixer:				
Turning at mixer	68	75	64	93
Backing to mixer	56	77	70	75
Dumping batches	23	128	200	303
Waits or delays	141	178	292	417
Total time constant per round trip	412	696	948	1,288
Total time constant exclusive of waits	271	518	656	871

TABLE 4.—*Average truck time constant on well-managed concrete paving jobs*

Operation or item	—Time consumed, in seconds— 1-batch truck	2-batch truck	3-batch truck	4-batch truck
Batcher plant:				
Loading sand and stone or gravel	12	48	90	150
Loading cement	24	47	73	102
Driving and maneuvering in material yard	42	54	60	65
Mixer:				
Turning at mixer	28	39	54	60
Backing to mixer	54	69	75	75
Dumping batches	19	110	157	265
Waits and delays	74	120	161	226
Total time constant per round trip	253	478	670	943
Total time constant exclusive of waits	179	358	509	717

into two parts. The first part includes the time spent while the truck is being loaded at the material yard, plus the time required for turning, backing, and dumping at the mixer, plus such waits or delays as are necessary or incidental to both these operations. The total time required for these operations is designated as the *time constant*. The second part is the time spent in travel between the materials yard and the mixer, and is designated as the haul. The items going to make up the time constant will be considered first.

An examination of many truck-haul jobs studied during the past three years shows average values as given in Table 3 for the items which go to make up the truck time constant, or the time which the truck spends each trip in other operations than actual driving on the road between the materials yard and the mixer.

Well-Managed Jobs Show Low Time Constants

While these are the average values for a large number of jobs and thus reflect the operating rates which might reasonably be expected on the ordinary job, they do not show what time is actually necessary to perform these various operations from day to day as indicated under actual field conditions. A smaller number of exceptionally well-managed jobs was, therefore, selected to afford a nearer approach to the theoretical values of these same items; these are given in Table 4.

On the average job, as shown in Table 3, the total time constant is 30 to 50 per cent larger than the net time constant. In other words, on the average concrete paving job about one-third to one-fourth of the actually observed gross time constant is due to waits and delays. Table 2 and the discussion following it show that on these jobs, so far as net working time is concerned, the mixer was operating at an average of about 26 per cent below its full capacity and to this loss of production the hauling equipment contributed about 12 per cent. If we include all hauling delays of more than 15 min. duration, the figure becomes 17 per cent, or more than half the loss of net working time. This is in sharp contrast to the average time constant on the well-managed jobs. On these the total time constant is on an average nearly one-third lower than on the average job and only about one-fourth of the total time constant is due to waits and delays as compared with about one-third on the average job. Perhaps the most striking difference is the fact that on these well-managed jobs the mixer was operating at an average of only 13 per cent below full production. To this loss the hauling equipment contributed only about 4 per cent or one-fourth as much as on the average job. The records show one job on which during two full months only 1.96 per cent of the mixer time loss was due in any way to the hauling equipment.

TABLE 5.—*Time of batcher operation as shown by studies of representative jobs*

Type of batching	Operation	Time in seconds
1-compartment batcher.	Weighing sand	7.6
	Setting scales	4.1
	Weighing stone	5.7
	Dumping and returning	5.6
	Total cycle	23.0
Sand and 1 size coarse aggregate; 2-compartment batcher.	Weighing sand	7.3
	Weighing stone	8.9
	Dumping batch	7.1
	Total cycle	23.3
Sand and 2 sizes coarse aggregate; 2-compartment batcher.	Weighing sand	7.8
	Weighing No. 1 stone	10.0
	Weighing No. 2 stone	7.0
	Dumping batch	5.0
	Total cycle	29.8

TABLE 6.—*Batcher operation in loading 3-batch trucks by means of a 1-compartment weighing batcher*

Operation	Time in seconds First batch	Second batch	Third batch
Discharging batch loaded while truck drives in	5.2	...	...
Setting scales	...	3.0	3.1
Weighing sand	...	10.9	11.6
Setting scales	...	2.4	2.9
Weighing gravel	...	4.2	4.1
Discharging batches	...	5.6	5.5
Delays and waits, seconds		7.8	
Total time to load 3-batch truck, sec.		66.3	

Another difficulty is that the operation of the hauling equipment is no more perfect that the operation of the mixer, and sometimes far less. Poor operation of the hauling equipment is quite as likely to occur when the mixer is functioning at its best and, therefore, requires perfect operation of the hauling equipment in order to avoid delays as it is when the mixer is functioning poorly and does not require so many batches per hour. The net effect of these non-concurring operating rates results in a bunching of trucks at the mixer when the trucks are operating well and the mixer poorly, and a lack of batches when the conditions are reversed. The extent to which contract hauling tends to aggravate these difficulties will be discussed later.

Since 100 per cent operating efficiency is not long maintained by either mixer or hauling equipment, it becomes necessary to have a certain apparent oversupply of hauling equipment to prevent mixer delays. The general practice is to have such a number of trucks that an average of from one to two batches will ordinarily be waiting at the mixer. In practice, this means that at times a dozen, or perhaps even more, batches will be waiting ahead of the mixer, while at other times the trucks will not be quite able to supply its demands. How and to what extent this present practice can probably be improved on will be discussed after we have examined some of the causes which affect truck operation at the batcher plant or material yards.

Yard Layout and Operation

One of the common causes contributing to a large time constant is a poor material yard layout. Usually there is no choice as to location, but too frequently the best use is not made of the location available. The general practice is to set up the batcher bins so that the trucks must turn and back under in order to receive their load. In fact, many bins are so built that a drive straight through is impossible. This is unfortunate, because turning, backing, and maneuvering a truck requires time which might otherwise be utilized in hauling batches. In fact, the yard layout and the routing of the several necessary operations should be planned as carefully as the performance of the several operations at the mixer.

The ideal yard layout would be one in which the trucks could enter at one end on a wide curve, drive straight under a loading bin having compartments for all the aggregates, pass on to a near-by cement-loading platform and storage shed, and then proceed on a tangent or easy curve to the main road. On p. 51 is a sketch of a yard layout which closely approached this ideal. The effect of the yard layout on the time constant is also shown in Tables 3 and 4. In any yard layout the unproductive truck time should be reduced to a minimum, as every deviation from this attainment results in an inescapable penalty in the form of more expensive hauling.

Modern bins and batchers can be operated so rapidly and with such regularity that there is usually no valid excuse for requiring the trucks to spend a long time at the loading plant. The modern batchers will ordinarily handle a 30 cu.ft. batch of sand and one size gravel in 5 to 35 sec., depending largely on how dry the sand is. If two sizes of coarse aggregate are used with a 3-way bin, the cycle will ordinarily be increased from 5 to 12 sec. For 1-batch trucks the actual

loading time is practically reduced to the time taken to dump the hoppers, as the filling and weighing can usually be accomplished while the loaded truck is passing out and the empty one is moving into position. Tables 5 and 6 give several values as found from time studies of batcher operation on representative jobs.

Unfortunately, the yard layout and operation procedure is seldom such as to permit full advantage to be taken of the rate at which the batchers can be operated. Frequently the yard layout is such that vastly more time is consumed in maneuvering and driving within the yard than in the actual operations of loading. Table 7 is the average record of a large number of time studies on yard operation in one yard. Two-batch trucks were used with a two-bin set-up in a supposed effort to facilitate the use of two sizes of coarse aggregate. A toll of nearly 2 min. was exacted from every load which was passed through this yard.

TABLE 7. — *Effect of poor yard layout on length of time required to load 2-batch trucks*

Operation	Time in seconds
Closing end gates of truck	27.5
Driving to gravel bin and backing under	34.5
Loading gravel, 2 sizes, 2 batches	67.0
Driving to sand bin and backing under	44.0
Loading sand, 2 batches	30.0
Driving to cement car	39.5
Loading cement bags	57.5
Waits and delays	9.5
Total time required for taking on load	309.5

Every interruption to the steady continuous operation of the paver on its fixed cycle results in a decrease below the otherwise possible rate of production. There is, therefore, practically no opportunity for any appreciable variation in the rate of any of the numerous dependent operations. Nor is there any chance to anticipate the requirements of these different operations, except at the loading plant, where there is usually some opportunity to provide sufficient storage of materials to eliminate the delays which might otherwise occur due to switching or the non-arrival of cars.

(To be concluded next month)

En Route
Between Material Yard and Paving Mixer

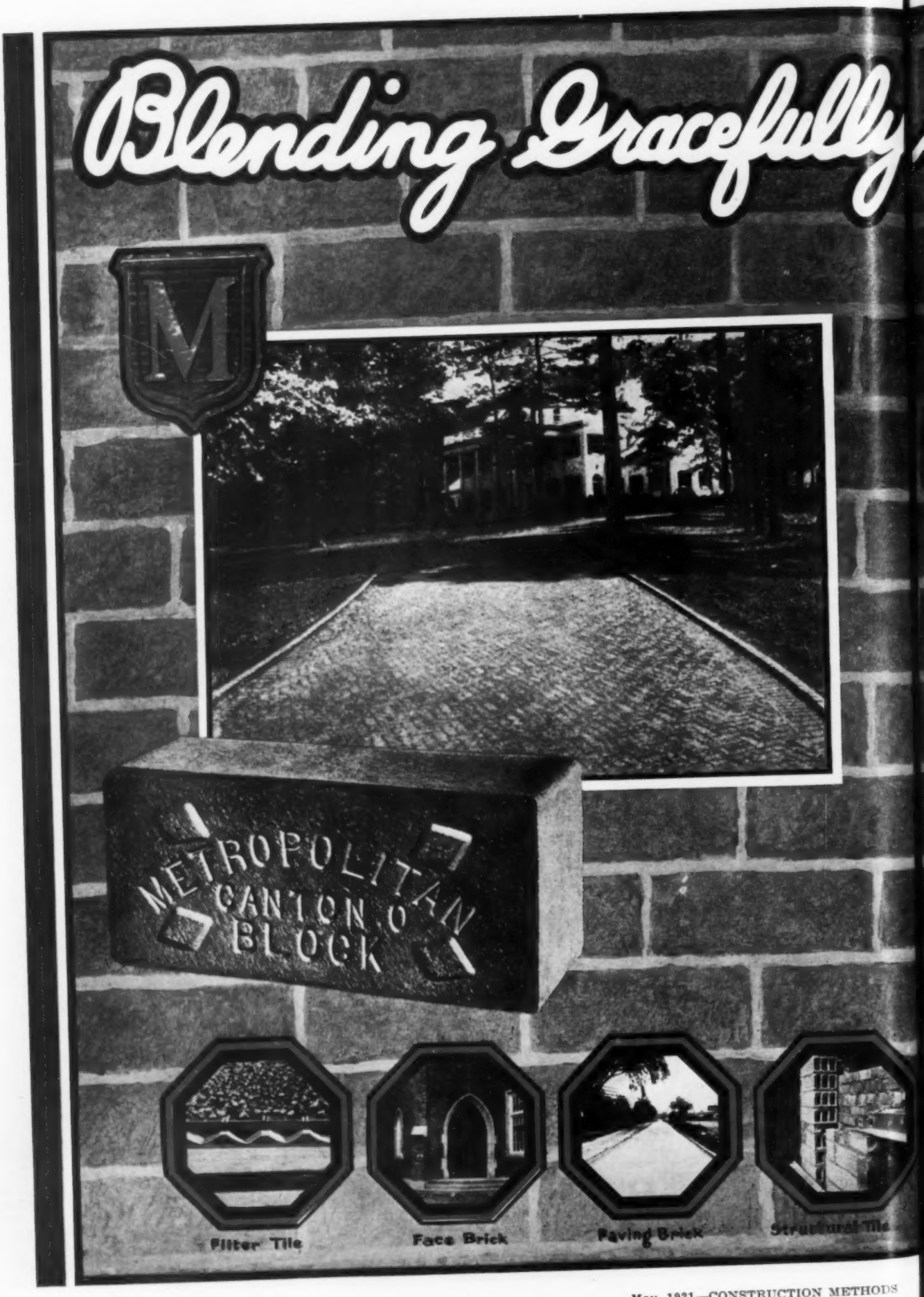
PATROL GRADER, regularly employed to maintain hauling road in good condition, should prove to be the best dividend producing equipment on the job.

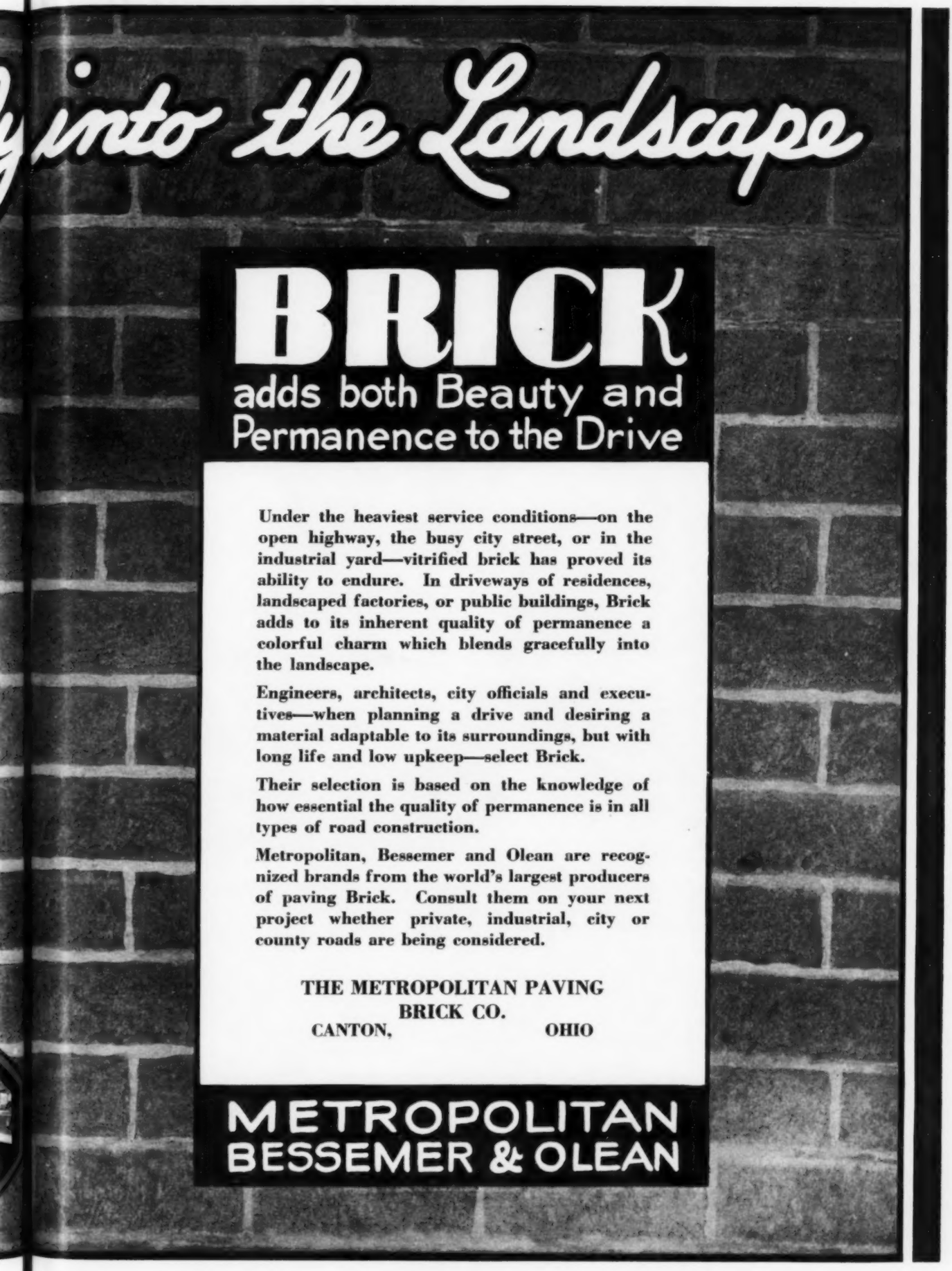
BRIDGING BAD SPOTS in the hauling roads with planks may mean the difference between capacity production at the mixer or a complete shutdown due to non-delivery of materials.

SLOW HAULING SPEEDS, only about 6 or 8 miles per hour, are the results of operating over roads like this.

WITHOUT TURNTABLE EQUIPMENT section of side forms is removed to allow batch hauling truck to maneuver into backing position for dumping into mixer.

TURNTABLES *(above)* **on subgrade a short distance ahead of the mixer will handle a three-batch truck in less than one minute.**


Blending Gracefully
M
METROPOLITAN
CANTON
BLOCK
Filter Tile
Face Brick
Paving Brick
Structural Tile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BRICK
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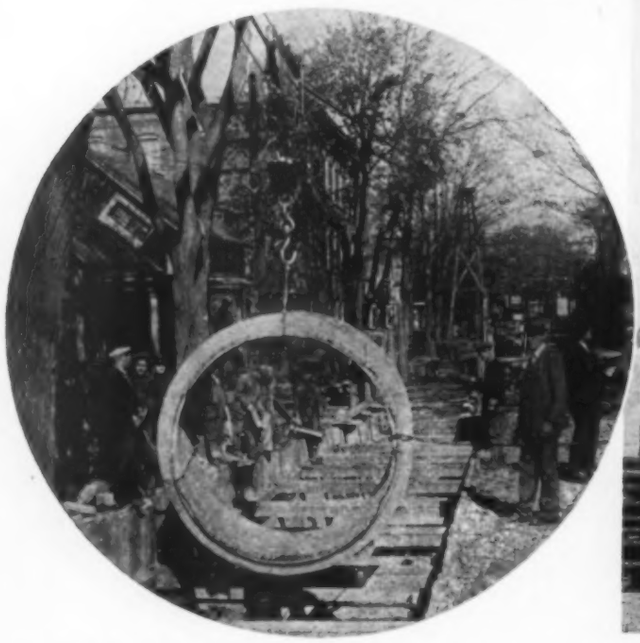
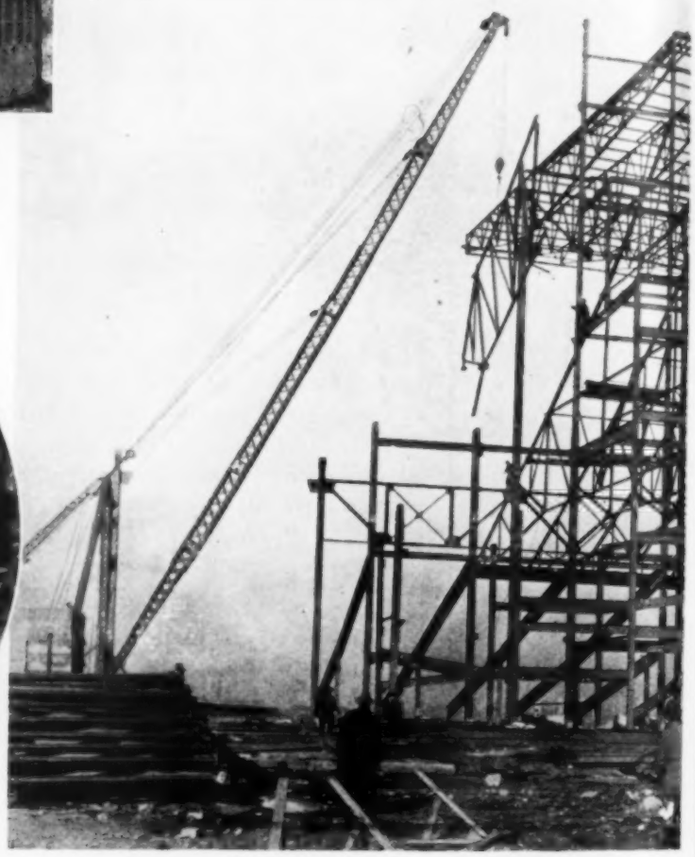
Getting Down to DETAILS

Close-up Shots of
Job Methods and Equipment

CONTRACTOR'S OFFICE need not be tumble-down shack. Attractive building of pink and gray quartzite houses home office of John Oman, Jr., general contractor, of Nashville, Tenn.



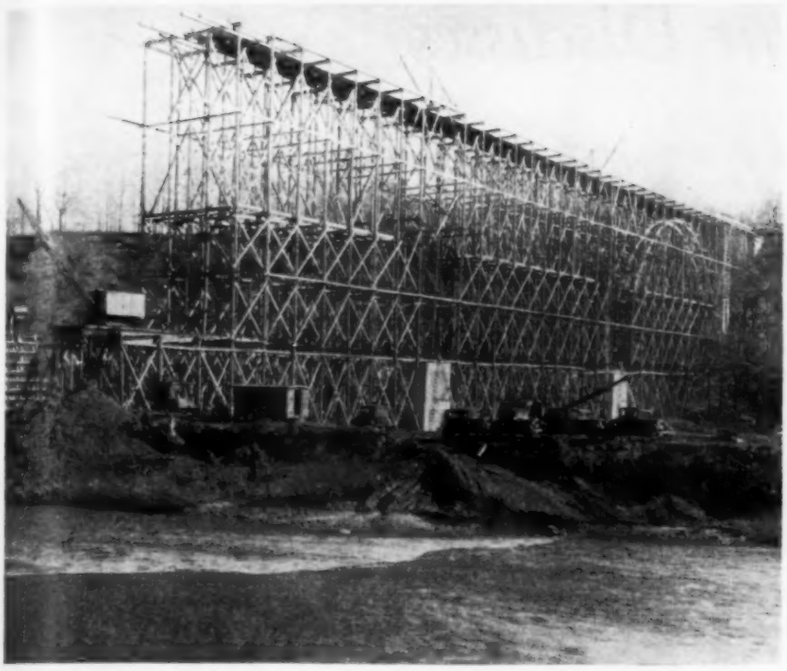
TOWER-CABLEWAY EQUIPMENT lays 84-in. precast concrete sewer pipe in sheeted trench for City of Manchester, N. H. Fay, Spofford & Thorndike, of Boston, were consulting engineers on the project.



125-FT. BOOM on stiff-leg derrick erects steel frame of Cleveland's new Municipal Stadium. Highest steel 105 ft. above ground. Bass Construction Co. used two rigs of this type.

Photo—La Technique des Travaux

THREE OPERATIONS AT ONCE. German machine, powered by diesel engine, excavates trench, lays electric cable and places backfill continuously. Excavated earth is carried back over trench by belt conveyor, covering cable unwound from reel on crawler-mounted carriage.



EXTENSIVE TIMBER FALSEWORK, designed by Alex Cross, superintendent, Highway Construction Co., for concrete highway bridge 1,130 ft. long across Cuyahoga River valley south of Cleveland. Forms for five 145-ft. arch spans are to be built into the falsework.

TO STEADY PILE HAMMER vertical pipe is rigged on derrick boom by Wemlinger, Inc.

MOBILE GASOLINE TANK refuels trucks on 38½-mile length of Missouri highway built by Hoeffken Bros. Construction Co., of Belleville, Ill.

NOVEL EARTH LOADER. On road grading job in California, Caterpillar tractor hauls pneumatic-tired Gardner machine which lifts earth loosened by blade to point of discharge into motor truck.

The Superintendent Discusses

LYING IDLE

THE pavement had been finished for about ten days. The cleanup had been completed the night before. Another job was past history—but it meant a good deal more than that to Bill for this had been his first real job as a superintendent. He was a youngster, and because he was a youngster he was wondering whether he had handled things so well that "headquarters" — which, after all, meant Jim, the company's general superintendent—would send him out again. As a matter of fact, the job had been well handled as every one else concerned with it fully appreciated. So it was not surprising that as Jim chatted with the engineers with whom he was driving over for the final inspection, the question uppermost in his mind was not whether the work would be accepted, but where he would put Bill when it was.

"I guess it had better be the big grading job at Sump's Corners," was his final decision. "New equipment requires new methods and it's easier to teach new methods to young men than to old ones! My superintendents are good men but, at that, I've had one hell of a time teaching some of them that machines aren't mules!"

The inspection over, Jim strolled away from the little group of engineers and local officials who were exchanging greetings and congratulations over the successful completion of the road. He felt they would hardly miss him as he was not on intimate terms with any of them. What was more, he wanted to have a few words with Bill. So after he had found a comfortable log some little distance from where the others were talking, he sat down and without attracting attention, motioned Bill to join him.

Jim wasn't much on formalities. "Bill," said he, "we want you to take charge of the Sump's Corners grading job. It's a good-sized job — about 250,000 cu.yd.—mostly common—but you will be able to handle it all right. And, let me say now, we're not putting you on this job to give you another trial or to let you down easy. A big grading job is a man's job! In fact, making real profits out of grading calls for everything any man has!"

"Thank you," Bill replied. "I'll do my best but you know, Jim, I've never handled much dirt."

"True enough, Bill, but that isn't quite the whole story. Handling dirt, like putting down pavement or laying brick or building houses is a matter of management. Someone must think the way through to a profit and then must make the job develop that profit. That's management."

"But, Jim, you have a number of men who have been in the grading game for years. Don't think I'm objecting to handling this job. I'm not. But I would like to know why I've been selected instead of these older men."

"Well, Bill, I've said something about management. That's the first reason. We want a man on this job who can think his way through to a profit and then go and get that profit. A lot of mighty good dirt movers feel that the only way to move dirt is to get out and move it. They can move it that way, sure enough, but it doesn't always prove very profitable!

"The other reason is that we are going to run an all-gas outfit—there won't be a 'hay burner' on the job—so we've got to stick strictly to modern methods."

"Just what equipment are you sending to this job, Jim?"

"We're sending two 1½-yd. shovels and a string of tractors and big wagons."

"Pretty expensive equipment isn't it?"

"It certainly is."

"It will work in all sorts of weather, I suppose."

"That's it, Bill, and that's one of the reasons you're being sent to that job. That outfit can work anywhere in pretty much any sort of weather, but on this job it will only work when the weather is good. Years ago, when the hay burners did all the hauling, conditions were different. The poor old mule had to be fed whether he worked or not. Fact is, he was a lot like some men I've known—the less work they did the more time they had to give thought and attention to their eating.

"What's more, in the good old days we used to feed the mule skinners as well as the mules whenever the weather was so bad that they couldn't work. As a result, it cost a lot of money to lie idle. I've seen camps where it cost almost as much to lie idle as it did to work. I visited an outfit of that sort last week. The follow who is running it has 26 mules. Keeping them fed costs him about $25 a day. There are 17 men in his mess. They don't feed any too well but it costs him about $15 a day to buy food and fuel. The foreman, the corral boss and the cook draw straight time and the blacksmith finds a lot to do on rainy days. The average cost of these men must be somewhere between $15 and $20 a day. That's at least $65 possibly $70 a day with all hands idle. I didn't ask much about wages, but I'm pretty certain that the wages paid the rest of the crew, over and above board, did not amount to more than $30 a day. That is the cost —all hands idle—is from $65 to $70 and with all hands at work only about $30 a day more. This was a small outfit but larger ones using a lot of horses and mules face about the same problem.

"With an outfit of that sort it is

DURING WET WEATHER

For Bill's Benefit, Jim Explains the Difference Between Just Moving Earth and Moving Earth at a Profit

easy to see that if the cost of running is only $30 a day more than the cost of lying idle, regardless of weather, it is better to work if more than $30 worth of dirt can be moved, for whatever is earned over and above that $30 serves at least somewhat to reduce what otherwise would be the dead out-of-pocket cost of lying idle.

"With a tractor outfit the principles involved are exactly the same but the ratio of the cost per day while lying idle to the cost per day with all hands at work is very different. With a horse outfit or a mule outfit the cost of lying idle usually is more than half of the cost with all hands at work. It may be more than two thirds as great. With a tractor outfit or a truck outfit the out-of-pocket cost of lying idle ought not to be as much as 10% of the out-of-pocket cost with all hands at work. Rather often it is even less than that. The tractors burn no gas and use no oil while they stand idle. Once in the sheds they need no further attention and are better off if left entirely alone. Drivers are not, as a rule, housed in camps nor are they paid for any time they are not actually at work. Your own salary and the wages of the time keeper, the watchman, and occasionally, the time of the mechanic are the only necessary expenses when the work is shut down.

"On the other hand, when work is done during bad weather, the cost of gas and oil, to say nothing of wear and tear on the machines is considerably increased—as a rule by more than the out-of-pocket cost of lying idle. Then, too, the amount of material handled is likely to be reduced. The net result, Bill, is that working in bad weather usually adds to the direct cost of moving dirt and as a pretty general rule, results in a considerable additional cost often not immediately apparent which is chargeable to excess wear and tear. In other words, while with a team outfit it usually pays to work if as much as half of the normal production can be secured—often if even less than this can be had—with trucks and tractors it seldom pays to work if weather conditions or bad hauling conditions reduce production more than 10%. It's cheaper to wait for better weather."

"Very interesting," was Bill's comment. "It sounds as though you want me to make a profit on that grading job by not working too much of the time!"

"That's about it, Bill. We don't want you to work unless you can satisfy yourself that it is profitable to work. Just getting out and moving the dirt won't make us a profit. To make any profit you'll have to do a lot of careful calculating as well as a lot of dirt moving and that's the place to start it!"

"I suspect you're right, Jim. At any rate I'll start the figuring at once. Got any other suggestions as to how that job ought to be handled?"

"Several."

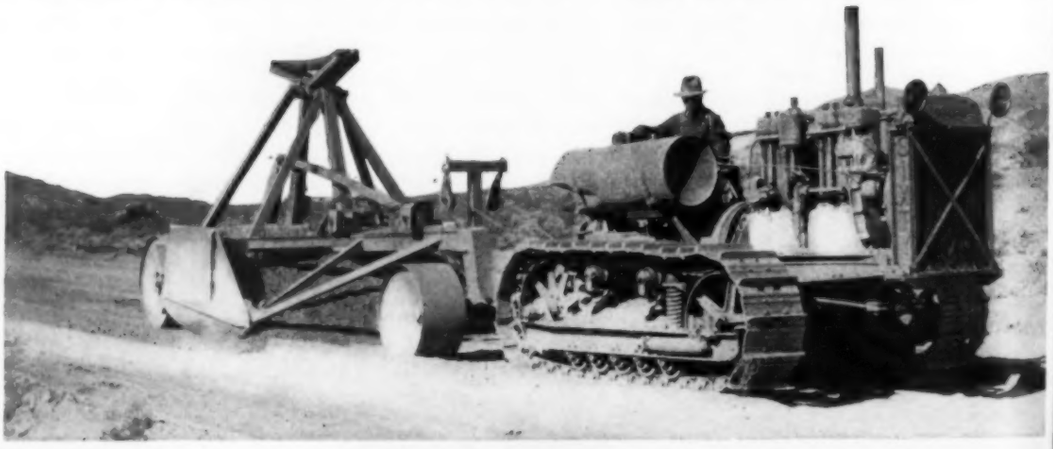
"Fine. What are they?"

"Not today, Bill, not today. Plenty of time for the others after you get the job started. I only mentioned this one because I wanted you to get the men started with the idea that this job will only work when the weather is good. Make it clear that you are not going to work in the rain or in the mud."

"I see the engineers are ready to go," said Jim, concluding the interview. "Get on the new job as soon as possible. We want a good profit on that job, but don't forget you may have to lie idle a lot to get it."

EIGHT-WHEEL TRAILER, equipped with pneumatic tires, carries diesel-powered air compressor to R. G. LeTourneau's highway contract. Three Caterpillar tractors push and pull 25-ton load up 28 per cent grade.

Opening Up Site of HOOVER DAM



HIGHWAY GRADING *(right)* between Boulder City and damsite is done with LeTourneau special 7-yd. scraper hauled by "60" tractor.

RAILROAD CUT through lava rock is excavated by one of the Lewis Construction Co.'s 1¼-yd. Lorain power shovels.

RAYMOND LEWIS CAMP *(below)*, housing 250 railroad construction men at base of mountains 3 miles back from Colorado River.

THREE - TOOTHED ROOTER *(right)*, pulled by tractor equipped with bull-dozer blade, prepares subgrade for highway to damsite.

CORRUGATED PIPE CULVERT *(below)* is laid across line of heavy fill on highway route.

EARTH-CARRYING CHARIOT of end-dump type handles 10-yd. load of spoil from power shovel excavation.

BULLDOZER on Caterpillar tractor spreads earth for construction of highway leading to the dam.

Building New York's Subways—VIII

TRUCK BODY WITH MOVABLE V SIDES pours precast concrete pads to be placed under false-work posts in subway trench by Carleton Co., Inc. Truck is loaded with sides in V position. Before dumping, sides are swung to vertical position.

Truck Mixers and Agitators Supply Subway Concrete

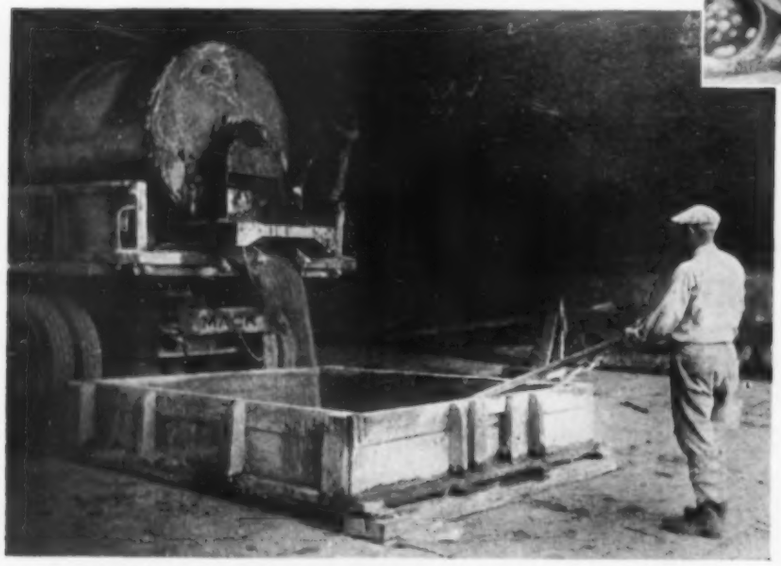
CONCRETE mixing practice for the New York City subway system is in a period of transition. The commercial mixing plant, the truck mixer, and the truck agitator are handling increasing quantities of subway concrete; and the portable paving mixer supplied by batch truck is producing a diminishing proportion of the total concrete requirements.

As lately as two years ago, most of the mixers producing concrete for subway structures were portable pavers owned by the contractor and supplied by the materials plant. The commercial mixing plant was making only a small percentage of subway concrete. Then, as now, the central plant on the job provided a large share (probably around 50 per cent) of the concrete on subway contracts.

Today a very different situation exists. The portable mixer is dwindling to minor proportions as a concrete producer; and the commercial plant, with its fleet of agitator or mixer trucks, has grown to major stature in the business. The truck mixer and agitator have made the change possible. Central job plants continue to hold their important position; but they, too, have adopted the truck mixer and agitator for longer hauls.

Concrete specifications of the Board of Trans-

UNDERGROUND MIXING PLANT *(above)* of Arthur A. Johnson Corp. eliminates elevated bins and material-handling crane. Material trucks dump into bins from street level. Tower bucket hoists concrete from mixer. Obvious disadvantage of plant is location of mixer in hole. SPECIAL HOPPERS *(right)* on light trucks take 1½-yd. loads from tower hopper and discharge concrete through bottom gates into deck funnel at top of elephant-trunk spout.



ROTATING DRUM with individual gasoline-engine drive, mounted in flat-bottom truck body, discharges into box on street deck. Man at right operates gates which pass concrete through spout to forms in trench.

Concluding a Series of Eight Pictorial Studies of Construction Methods on New York's New City-Owned $650,000,000 Subway System

portation have a definite effect on development of new mixing machines and methods. Under the direction of George L. Lucas, division engineer, the division of materials conducts tests which indicate the requirements to be enforced for each type of mixer and agitator. As a result of the division's studies, specifications allow 30 min. maximum elapsed time between mixing and depositing of concrete when the batch is transported in a machine which preserves the workability and uniformity of the mass. For concrete carried in a stationary body, the maximum elapsed time permissible is 15 min. Dry batches of aggregates and cement, placed in a mixer drum at the plant, may be hauled for 1 hour before adding water and mixing at the job. No mixing in transit is permitted.

Truck mixer drums must be revolved ten times at the plant, after the dry materials are introduced, and 50 times at the job, after water has been added, to mix the batch. Drums with spiral blades are turned half of each number of revolutions in one direction and half in the other, tests having indicated that this reversal of motion is necessary to obtain complete mixing. Many of the truck mixers are equipped with two water tanks, one for concrete and the other for flushing out the drum. To eliminate possibility of mistakes, the engineers allow only the measuring tank for batch water to be filled.

Truck mixers used on subway construction are of three types. A 5-yd. rotating drum on one type is driven by power take-off from the truck motor. The drum is raised to dump. Two other mixers, of 3- and 4-yd. capacity, are

AGITATOR BODY *(right)* has paddles rotating slowly on shaft. J. F. Cogan Co. uses these trucks to deliver from central mixing plant on job.

FLAT - BOTTOM TRUCK *(below)* carries concrete from central plant on contract section of Rodgers & Hagerty, Inc. This type truck is passing out of use for concrete hauling.

WHERE SPACE PERMITS, contractors still prefer to erect own central mixing plant in many cases. Necaro Co. *(left)* stockpiles aggregates and charges bins with clamshell on derrick boom.

ROLL-OVER BODY *(below)* of 2-yd. capacity, dumped by man turning crank, transports concrete from Necaro plant.

PAVING MIXER, charged by batch truck from commercial plant, pours concrete on roof arch forms for Di Marco & Reimann, Inc. Use of pavers is becoming very limited.

TRUCK MIXER, of 5-yd. capacity, hauls dry batch from commercial plant and adds water and does mixing on job. Mixing in transit is not permitted.

equipped with spiral blades or buckets which discharge the drum, when it revolves in one direction. The drums of these two mixers often have separate motor drive.

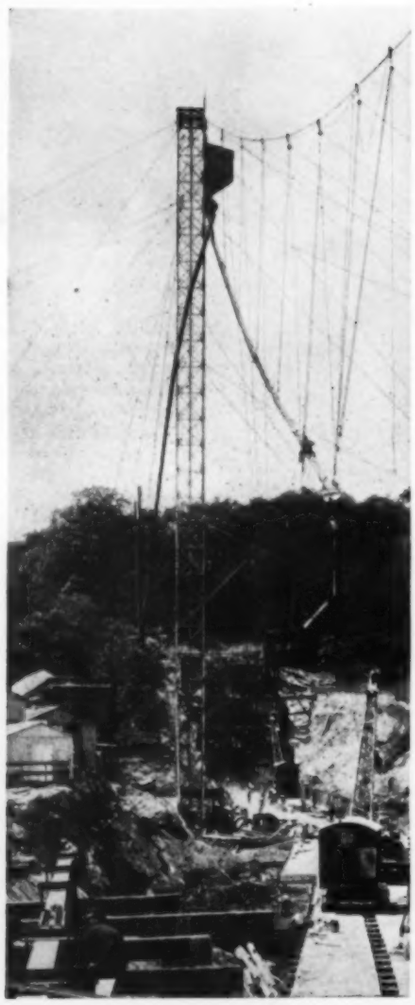
Machines to preserve the workability of wet batches are of two kinds, the rotating drum without blades and the open, "Bathtub" body with revolving paddles on a shaft. The division of materials classifies the truck body with movable V-sides in the same category with the stationary bodies—15 min. time for wet batch hauling.

The flat-bottom body is giving away to the roll-over and hopper types for short hauls from central plants. Lighter trucks and easier handling make the change economical in most instances.

In the central and commercial mixing plants, the mixing period depends on the size of the mixer, varying from 1 min. for a 1-yd. machine to 2 min. for a 3-yd. Present requirements for batching equipment call for weighing devices for sand, weight or volume measurement for gravel, and weighing of bulk cement or use of cement in bags.

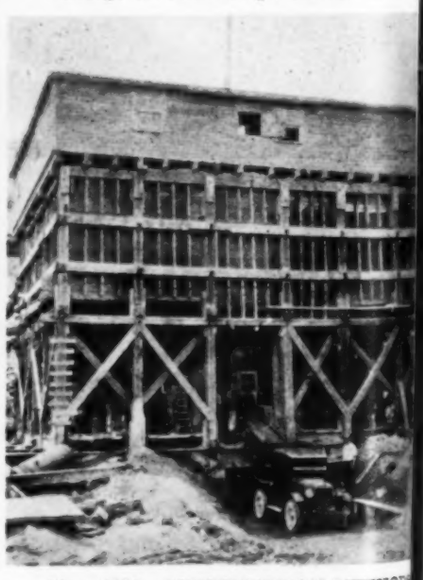
Although the Board of Transportation uses what is called a 1:2:4 mix, it really amounts to a 1:1.75:3.50, because the 94-lb. bag of cement is con-

FLEXIBLE SPOUT *(below)* is almost universal means of placing concrete. Crew of Atwell-Gustin-Morris, Inc., pours track sub-base.



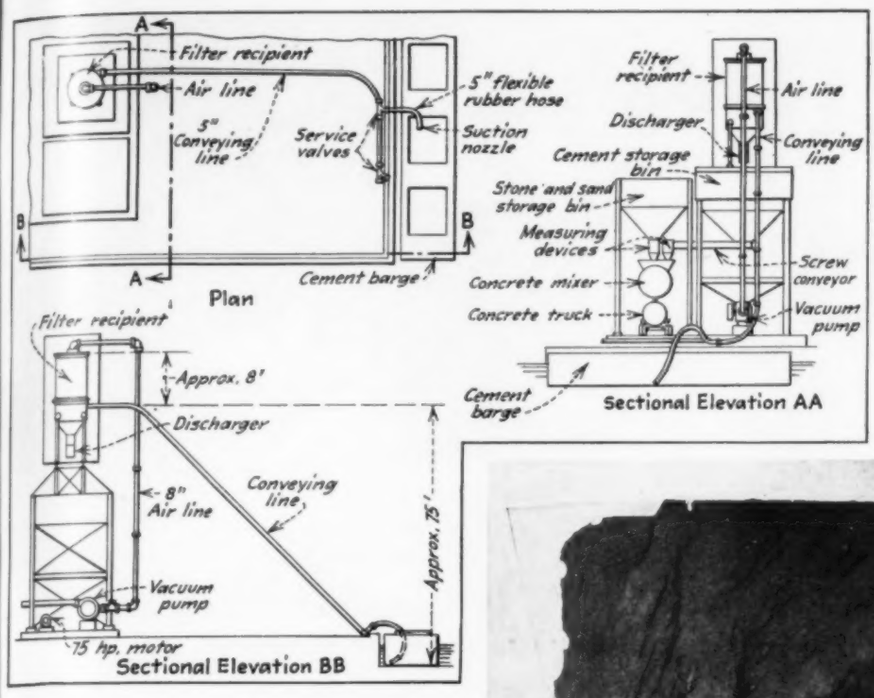
FIVE YEARS AGO,* Arthur McMullen Co. found rare use for tower chuting plant on section where subway structure rises to surface. Present water-cement ratio would prohibit chuting.

HILLSIDE MIXING PLANT *(below)* takes advantage of topography. Trucks on upper level dump directly into aggregate bins. George H. Flinn Corp., contractor.



sidered only $\frac{7}{8}$ cu.ft. in volume. The maximum quantity of water permitted is $6\frac{1}{4}$ gal. per sack of cement, including moisture in the aggregates.

Administration—In general charge of the design and construction of the New York City subway system for the Board of Transportation is Robert Ridgway, chief engineer. John R. Slattery, deputy chief engineer, directly supervises construction.



PLAN AND ELEVATIONS *(left)* of Carleton Co.'s waterside mixing plant, which uses pneumatic system to lift bulk cement from barges.

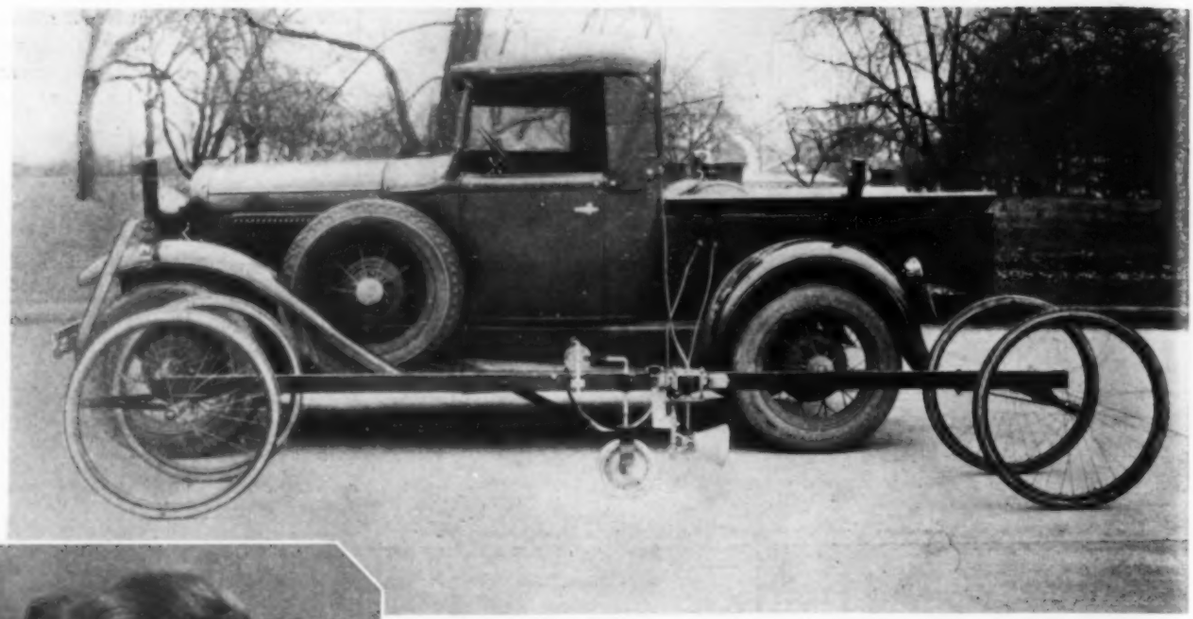
FRONT OF PLANT. Truck is being loaded. Steel stiff-leg derrick with 100-ft. boom, driven by 100-hp. electric motor, fills aggregate bins from barge alongside wharf.

NO DUST in cement barge as suction nozzle takes away material at rate of $9\frac{1}{2}$ tons an hour.

REAR OF PLANT. Air line removes air from top of tower; conveying line carries cement from barge.

MIXER TRUCK transports ready-mixed concrete from plant to job. This type mixer has spiral blades inside drum. To discharge, drum is revolved in proper direction.

HOSE from suction nozzle connects with service valve on conveying line. Plant normally operates at around 17-in. vacuum. When cement is fed too fast to nozzle, vacuum rises to 20 in. and safety valve opens on air line at pump.



EASILY ATTACHED to side of light motor truck.

BUMPS IN PAVEMENT

Detected and Marked Automatically

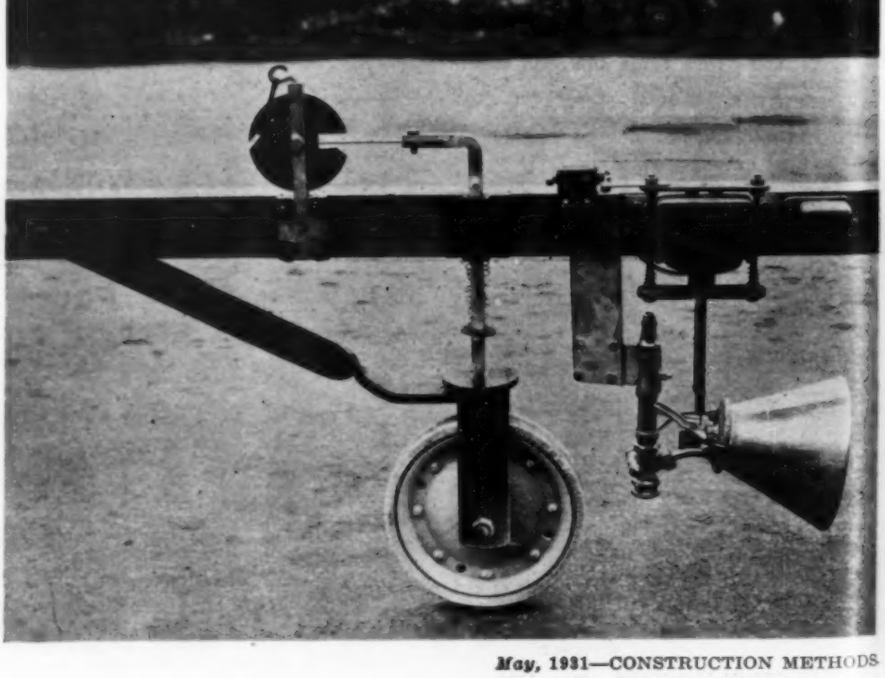
By EARL V. MURRAY
Ohio State Highway Department

NEAL MOLER, designer of new type of profilometer.

OHIO'S state highway department this year has introduced an entirely new type of "profilometer" which not only detects irregularities in the surface of newly constructed pavements, but also marks them with a shot of white paint applied automatically by a pneumatic spray gun.

The new machine has many advantages over the old 16-wheel recording type of equipment. It consists of four bicycle wheels upon which is mounted a straight-edge, with an indicating wheel in the center. The straight-edge is either 10 or 18 ft. long, depending upon the type of pavement to be tested.

No written record is made by the new machine. Instead, a paint spray gun, operated electrically and powered from the automobile battery, instantly marks any high or low spots. Air for the gun is supplied



OPERATING MECHANISM *(right)*, showing wheel whose vertical movement, when passing bump or depression, closes electrical circuit, causing spray gun to discharge white paint.

PACKED UP *(left)* ready for transport from one job to another.

AIR TANK *(below)* at rear of motor truck body supplies paint spray gun.

from a tank carried on the automobile. The air tank is refillable at any gasoline service station.

Upon passing over an irregularity exceeding the limit allowed by the specifications the indicating wheel closes an electrical circuit, causing the gun instantly to spray white paint on the spot that is faulty. Mounted on the machine is a tabulator which keeps a record of the number of irregularities. A bell enables the operator to check the functioning of the spray gun.

Depending upon the type of pavement, depressions or high places may not exceed $\frac{1}{2}$ in. in 18 ft. for certain types and $\frac{1}{4}$ in. in 10 ft. for others.

Advantages—The new machine designed by Neal Moler, assistant engineer in the state highway department, eliminates the services of an analyist and the necessity of a typewritten report, as was required with the old type profilometer. In the past, it was necessary to send the records to Columbus for checking, after which a typewritten report was made, all of which meant time and the possibility of error.

BUILDERS OF NEW MACHINE. *(Left to right)* T. C. WOODE, mechanic, FRANK CASUTORUS, operator, and M. B. THOMPSON, garage foreman.

MARKED FOR REPAIR *(below)*. White paint on paved surface shows exact location of high or low spots.

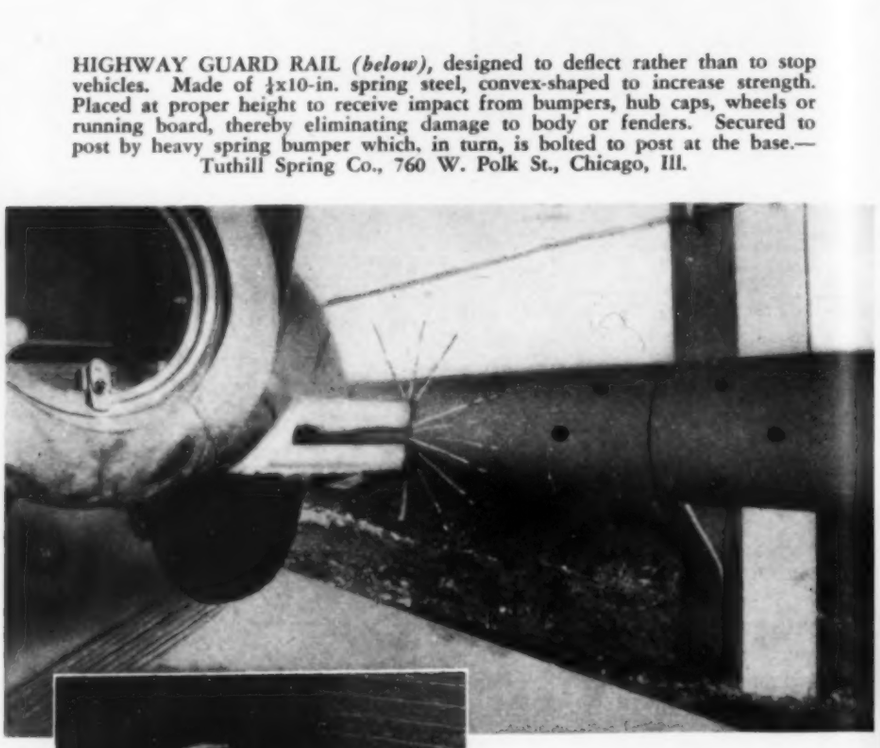
The new machine is light, compact and easily transported from one job to another. Its actual weight is 70 lb., whereas the discarded type weighed 1,600 lb. and required a trailer 23 ft. long. In transporting the new machine, which can be quickly assembled and dissembled, the wheels are removed and carried in the rear of a light truck; the beams are carried on the sides.

The entire arrangement eliminates an assistant operator, the analyst, copying of report by typist, cost of recording paper which alone amounted to $500 annually, the use of a trailer, and decreases by half the time for assembling and transporting.

NEW EQUIPMENT

ELECTRIC HOIST, with pendant rope control, handles rolls of wire. Equipped with motor specially designed for high operating speed; alloy steel shafts; drop-forged, heat-treated gears and pinions, and Trulay-Preformed cable. Suited both for indoor and outdoor installation. Also furnished with push button control.—Wright Manufacturing Co., Bridgeport, Conn.

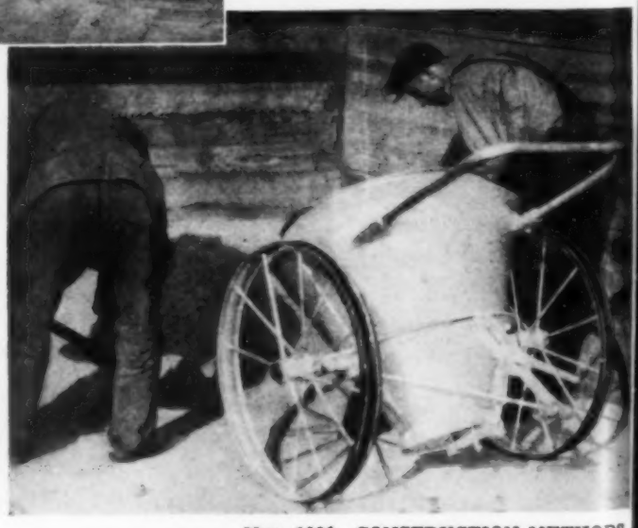
HIGHWAY GUARD RAIL *(below)*, designed to deflect rather than to stop vehicles. Made of ¼x10-in. spring steel, convex-shaped to increase strength. Placed at proper height to receive impact from bumpers, hub caps, wheels or running board, thereby eliminating damage to body or fenders. Secured to post by heavy spring bumper which, in turn, is bolted to post at the base.—Tuthill Spring Co., 760 W. Polk St., Chicago, Ill.



WOOD BLOCK FLOORING *(left)* for practically all domestic, commercial and industrial purposes. Evanite may be had in variegated colors and in geometrical and modernistic shapes. Standard thickness 25/32 in.; Sizes 6x12, 9x9, 6x6 and 12x12 in. Exclusive feature is dowel pin construction which prevents cupping, warping and changes of size or shape.—National Wood Products Co., Howard City, Mich.

FOR HANDLING BULK CEMENT, "Konekart," of galvanized steel, with toggle locked valve to provide bottom discharge. Loading is speeded by large opening at top and tilting feature which lowers shoveling height. Made in 3 sizes: 7¼-, 8 2/5- and 10 1/3-cu.ft.—C. S. Johnson Co., Champaign, Ill.

CONTINUOUS-ACTION CHAIN EXCAVATOR for digging and cleaning irrigation and drainage systems and for building highways and levees. Equipped with patented, automatic self-cleaning buckets. Supported by main crawler 24 in. wide and 12 ft. long and an extension crawler mounted on telescoping pipe shaft 12 in. wide and 7 ft. long. Has four forward digging speeds, two reverse speeds and two elevator digging speeds.—Ruth Dredger Manufacturing Corp., Ltd. 5980 S. Boyle Ave., Los Angeles, Calif.



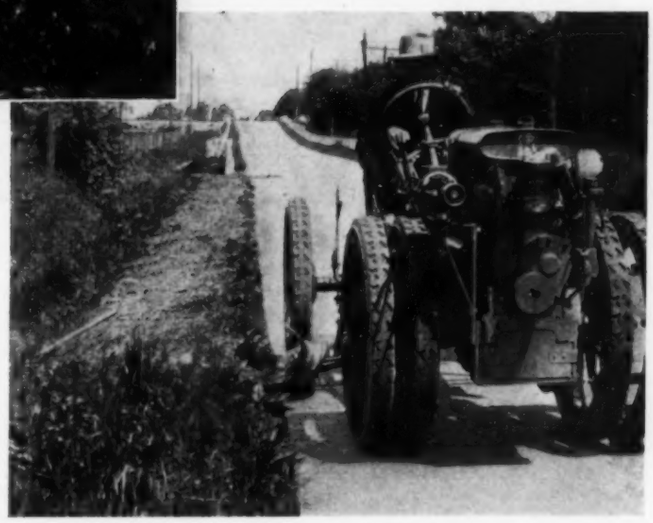
on the Job

12-CU.YD. DRAG SCRAPER *(below)* almost 6 ft. high and measuring 11 ft. across, operated by Sternberg Co., Inc., with a levee-building tower machine in the Greenville, Miss., district. Although it brings in load of 16 to 17 tons of earth, bucket itself equipped with chains and teeth weighs only 5½ tons. Other advantages claimed are easy and uniform digging with minimum of power, and speedy and clean dumping. — Sauerman Bros., 438 S. Clinton St., Chicago, Ill.

¾-YD. SHOVEL, equipped with new type crawlers and driving mechanism, being used as a piledriver in the construction of a sea wall on the river front in Cedar Rapids, Iowa, by the Wickham Bridge & Pipe Co., Council Bluffs, Iowa. Crawlers are lug-driven, 16 in. in width and hinged by three eyes. Traction shaft is splined, no keys being used, and is made in three sections rather than one, thus facilitating adjustments and repairs.—Speeder Machinery Corp., 1201 S. Sixth St. W., Cedar Rapids, Iowa.

HIGHWAY MOWER *(below)*, a one-man machine, designed to cut heavy weeds and brush from roadsides. Equipped with automatic clutch brake, flexible hitch, foot and hand clutch control and shoe suspender. Weight 2,500 lb. Mower has 12-in. lift for cutting over berm or curb. Cuts at an angle of 30 deg. up or down.—Centaur Tractor Corp., Greenwich, Ohio.

WIRE TWISTER *(left)* for twisting tie wires around reinforcing rods or for wiring snow fences to iron posts. Made of ¼-in. cold rolled steel, with hardwood handle and a 2-in. offset which gives powerful leverage and readily twists 18-, 16-, 14- or 12-gauge wire.—M & M Wire Clamp Co., 983 17th Ave., S. E., Minneapolis, Minn.



HYDRAULIC AUGER *(left)* for boring 100 ft. or more under thoroughfares, buildings and gardens without necessity of trenching. Driven by compressed air and connected with running water, 30-lb. pressure being sufficient for operation. Design enables operator to direct bore within 2 or 3 in. of designated point. Two models —one for 2½- to 5-in. diameter holes and one for 5- to 10½-in. holes.—Hydrauger Corp., Ltd., 1298 Bryant St., San Francisco, Calif.

Present and Accounted For —

A Page of Personalities

LEWIS W. BALDWIN, president of the Missouri Pacific Lines, was elected to the presidency of the American Railway Engineering Association at its recent annual convention in Chicago. He was formerly associated with the Illinois Central Railroad as vice-president in charge of operation.

©Acme

FRANK T. CROWE has been appointed by Six Companies, Inc., as general superintendent in charge of constructing the $49,000,000 Hoover dam and power house on the Colorado River.

JOSEPH S. STRINGHAM, former commissioner of public works, has been named city engineer of Detroit, Mich. In addition to early experience on mining properties in the West and on canal surveys on the Isthmus of Darien, Mr. Stringham served for 11 years as construction engineer for the Solvay Process Co.

NEW EXECUTIVE CABINET of the Associated General Contractors of America. *(Left to right)* E. J. Harding, managing director of the A.G.C.; A. E. Horst (Henry W. Horst Co.), Philadelphia; B. L. Knowles (E. D. Ward Co.), Worcester, Mass.; T. J. Baker (Coddington Eng. Corp.), Milwaukee, Wis.; Richard Hopkins (Richard Hopkins Co.), Troy, N. Y.; A. P. Greensfelder (Fruin-Colnon Contr. Co.), St. Louis, Mo.; David J. White (Bay State Dredging & Contr. Co.), Boston, Mass.; George B. Walbridge (Walbridge-Aldinger Co.), Detroit, Mich.

It Costs Money Not to Know About This Machine!

If you aren't familiar with the many services a Universal Truck Crane has to offer, you are probably paying out good money that can otherwise be saved. ▲ On short jobs of digging, loading cars, steel erection, bridge repairs, material handling, you may be paying transportation charges for slower equipment or, you may be paying the extra cost in time of doing the job by a make-shift rig. ▲ A Universal Truck Crane eliminates these charges because it is always mounted on a motor truck ready to get to the job in a hurry. And it brings just the right boom equipment for the particular job to be done. ▲ Let us tell you about the service Universal Crane Rental Service Companies have to offer and about the 101 jobs the machine is built to do.

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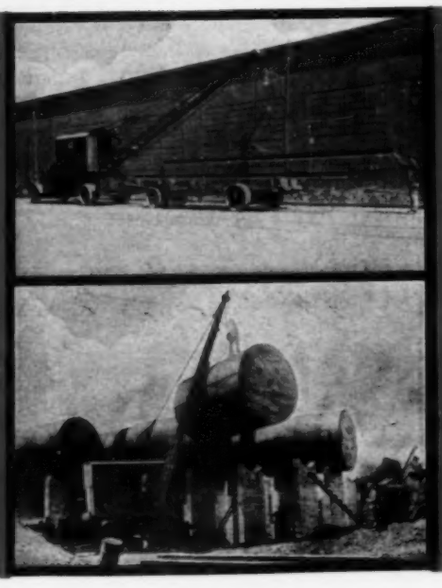

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Universal Crane Rental Service offers you an exceptional opportunity—to make $5,000 to $10,000 a year and upward, running your own business. There are still desirable Crane Service territories open. Write for details and plan outlining complete Crane Service.

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MORE miles per day are *built into* Wehr Equipment .... that's why road men get more miles per day *out of* these rugged, massive machines!

Note the heavy blade work being done by the Wehr Grader above. This unit, doing much overload work in loose dirt and soft, filled-in lake sand, helped John A. McGarry build the Chicago Leif Ericson Drive in record time.

Wehr ability to withstand great punishment is the result of *full knowledge* of road machinery requirements. Ten years of experience in the manufacture of one-man power graders enables Wehr to design and build road equipment that delivers years of profitable service.

There are many Wehr features which can be effectively demonstrated on your present jobs. Let Wehr GREAT STRENGTH help you make a new record of steady construction profit! Write for Wehr details, and the name of your nearest dealer.

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More Miles Per Day

NEW Model F Self Priming Homelite portable centrifugal pump operating with a suction lift of 31 ft. 6 in. exceeding guarantee by 3 ft. 6 in.

"Some Lift!"

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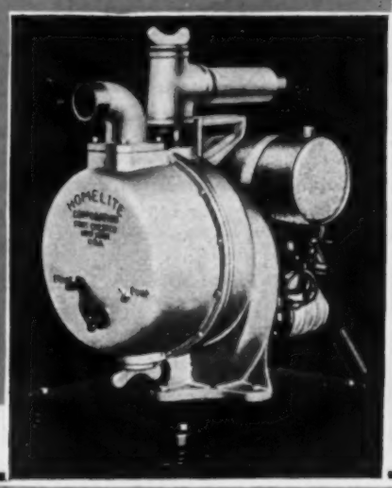

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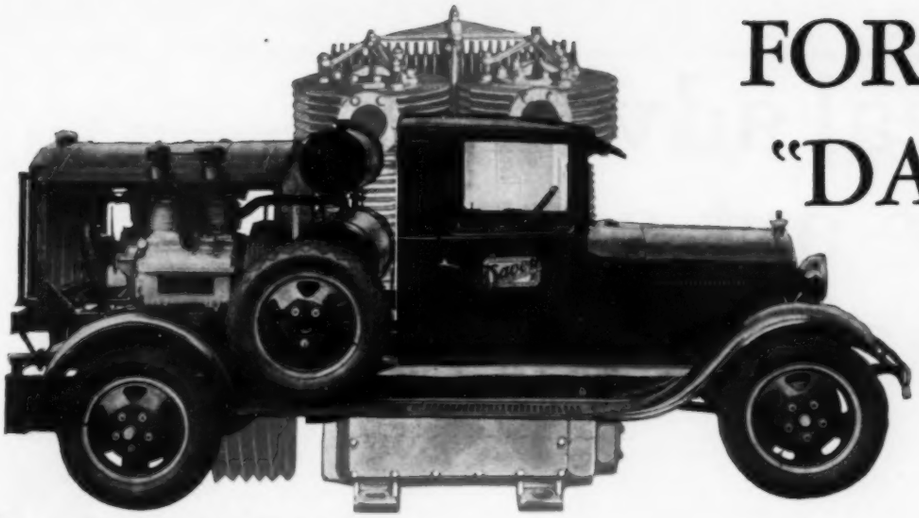

The method of cooling air compressors through the use of metals of high heat conducting quality and capacity, as contained in Davey Compressors, is fully protected by patent.

"TEAM-MATES" *in motor and compressor performance . . .*

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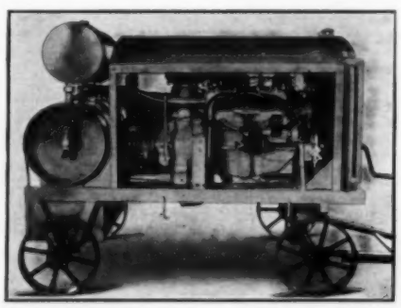
Wherever you need a dependable supply of compressed air, you get it quicker and cheaper from this Ford-powered Davey Compressor mounted on a standard Ford short wheel-base chassis. This combination outfit goes wherever you can drive a Ford car—gets there quick, starts with a twist of the crank, or the turn of a self-starter switch, and settles down to pumping air with the throw of a clutch.

Its extraordinary mobility is due to its light weight. The full-size 110 cu. ft. Davey Compressor unit uses aluminum alloys for the finned compressor heads and manifolds. This eliminates heavy cast-iron water jackets and other cooling paraphernalia. Hence the complete compressor outfit weighs fully 600 lbs. less than water-cooled combinations of similar capacity.

"Air-cooling," which retards carbon formation, is responsible for the Davey Compressor's 5-year reputation for sustained efficiency. The Ford Model "A" Industrial



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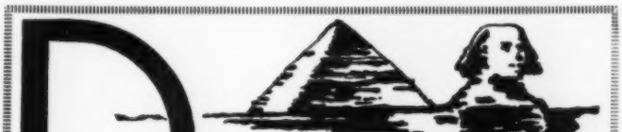

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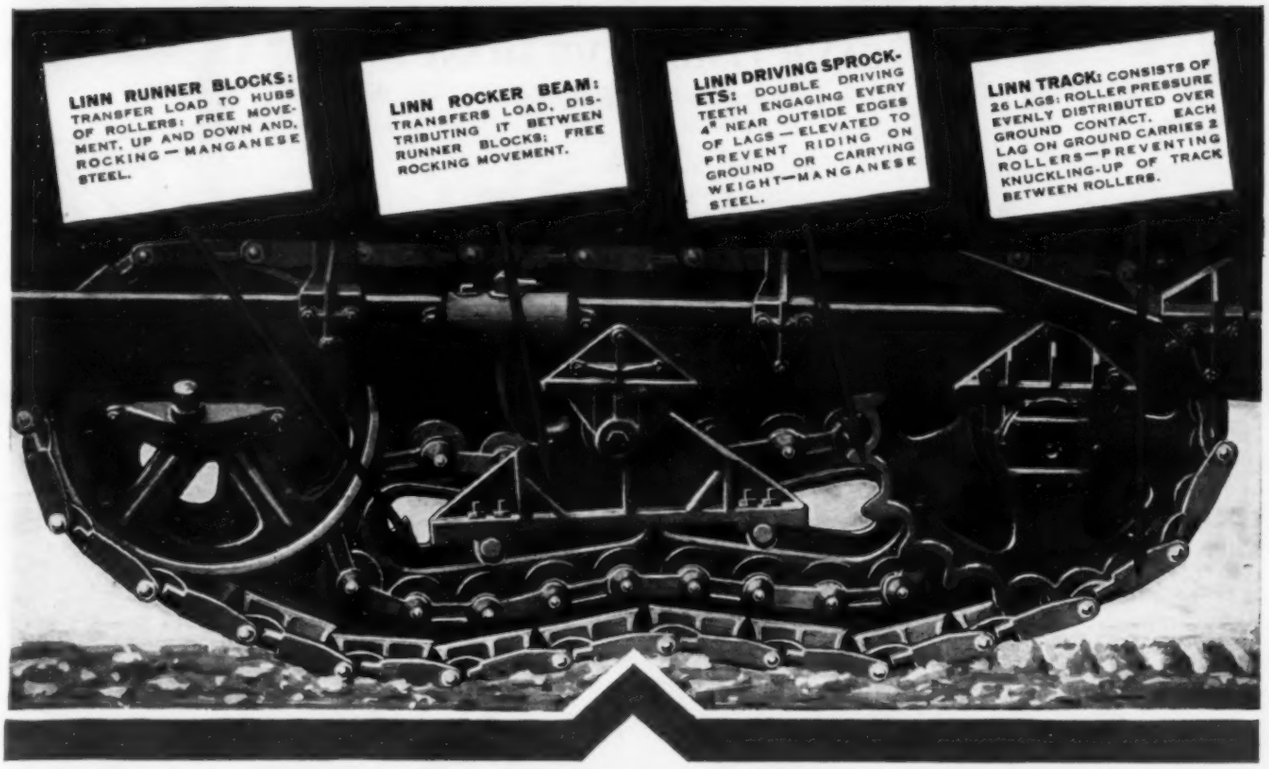
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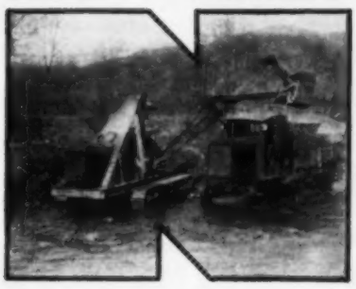

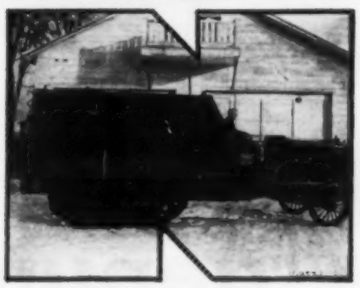

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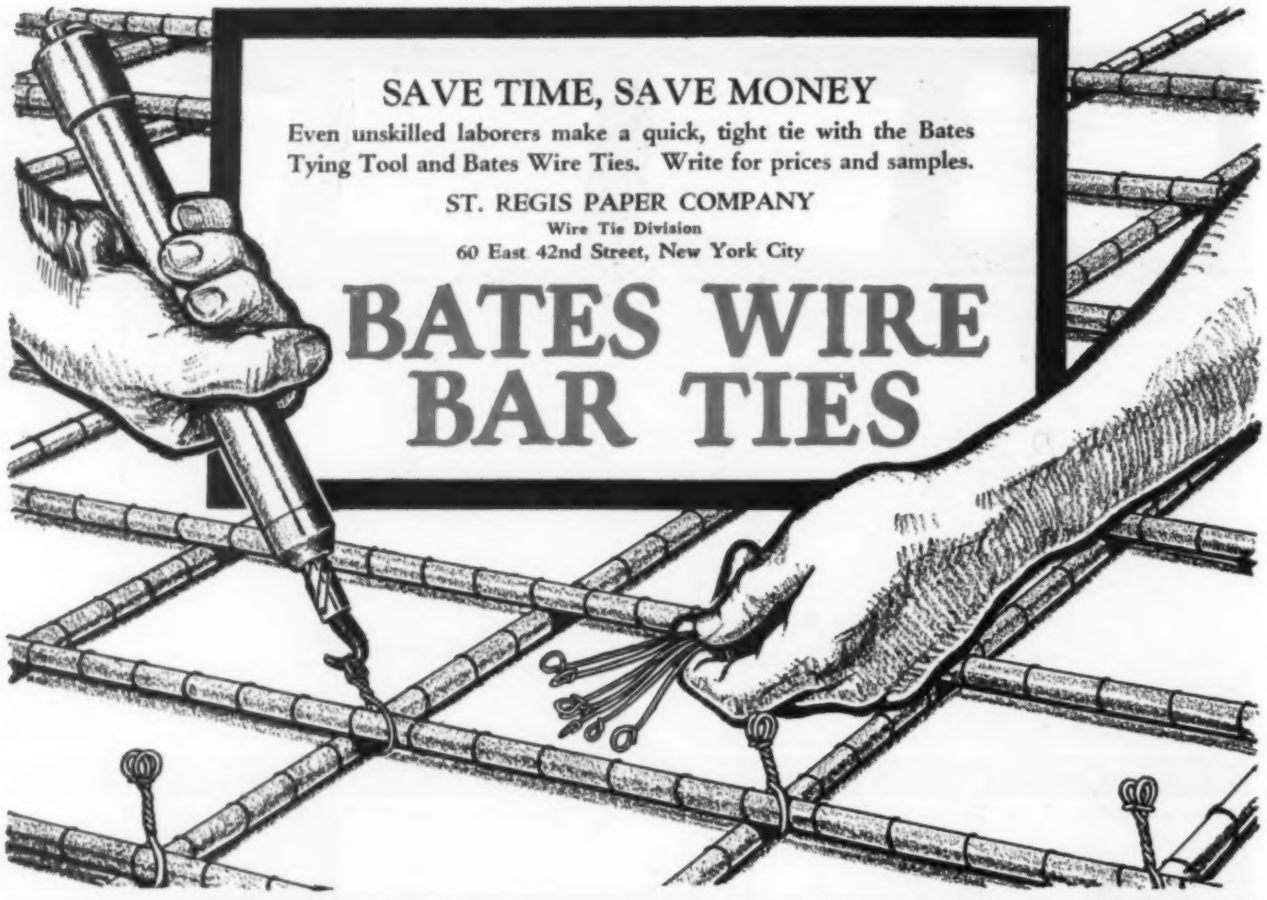

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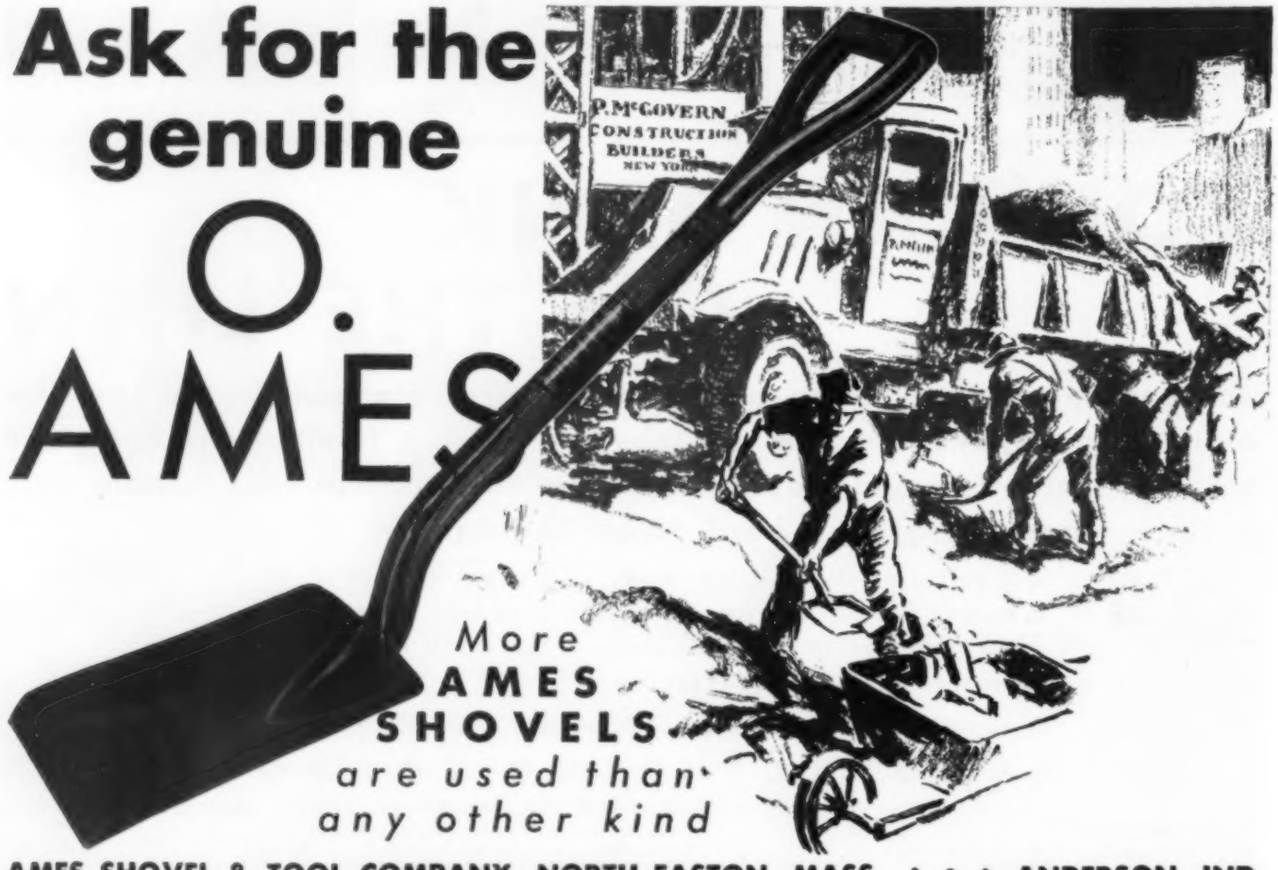

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WHERE THE GOING IS HARD

On exposed gears . . . DIXON'S clings to the teeth providing a protective coating that greatly reduces friction.

On wire ropes . . . the graphite penetrates the strands, thoroughly lubricating them.

On pump plungers . . . it coats the surfaces with a film of graphite, decreasing friction and extending the life of the equipment. On any exposed equipment . . . it prevents rust.

DIXON'S Waterproof Graphite Grease maintains a wear-resisting graphite surface between parts that otherwise would be in metallic contact. It is remarkably adhesive without being gummy or sticky. Water will not wash it off. It is unaffected by sea water, alkaline or acid waters. It is the ideal lubricant for heavy service.

DIXON'S WATER-PROOF GRAPHITE GREASE

Other DIXON Products

Flake Graphite
Graphite Seal
Graphite Cup Grease
Pipe Joint Compound
Belt Dressing

Joseph Dixon Crucible Company

Jersey City New Jersey

104 YEARS OF DIXON SERVICE

Hundreds are adopting this Economical Torch . . . It's the Torch you will want to use on your job

Here is DEPENDABLE LOW PRICED Protection

The construction field wants economy—and the Cleveland Flaming Torch gives it. First in fuel economy—for it burns steadily 36 to 48 hours on only three quarts of oil and in any kind of weather. Second—the cost of the Cleveland Flaming Torch is attractively low. Here is a "double-barelled" saving that, with dependability and other features, makes this torch so popular.

Use Cleveland Flaming Torches on your next job and pocket the savings.

Write

You will want prices and further details. Order a trial lot or tell us your quantity requirements and let us quote.

Dealers

Some territory is available. Write for Cleveland Flaming Torch proposition.

THE CONSOLIDATED IRON-STEEL MFG. CO.
1290 E. 53rd St., Cleveland, Ohio

CLEVELAND FLAMING TORCH

H7 SINKER C7 PAVING BREAKER

Let us Demonstrate These Unusual Tools To You

POWERED for PROFITS

Profit on the job is the thing—and the H7 Sinker and C7 Paving Breaker play a big part.

They're fast—with smashing power to accomplish more. They're economical—a fact proven by tests showing Clevelands to be unsurpassed.

For this summer's work you will want their efficiency, dependability and economy.

Let us put one in your hands for trial.

THE CLEVELAND ROCK DRILL CO.
3734 East 78th St., Cleveland, Ohio
Branches, Agents and Service Stations in Principal Cities.

Three other valuable Cleveland tools *are the 5B Back Fill Tamper, TD5, Trench Digger* and *CD5 Clay Digger*. They're time savers worth knowing more about.

CLEVELAND ROCK DRILLS

No. 8 of a series of advertisements on "How Superlative Quality is Built into Roebling Wire Rope".

WHERE STEEL GETS ITS *STAMINA*

IT IS in the wire drawing mills that the wire for Roebling "Blue Center" Steel Wire Rope gets much of the toughness and durability for which it is famed.

Here, the wire is cold drawn through steel dies—in and out, again and again. Then at carefully calculated intervals it goes to the tempering furnaces—then back for further drawing. And during every step of this process, additional stamina is slowly and painstakingly "worked" into it.

At Roebling, wire drawing is considered of vital importance. Infinite care is exercised throughout the operation and the methods used are based on years of development. Only highly skilled wire drawers are employed and most of these men have had from 10 to 35 years of experience.

ROEBLING **WIRE ROPE**

"BLUE CENTER" STEEL

50 *miles of* ROEBLING ROPE

. . . for Diablo Dam

WEDGED in a solid granite gorge, 100 miles northeast of Seattle and damming the turbulent Skagit River, is a colossal concrete barrier. It is the recently completed Diablo—world's highest concrete arch dam —1180 feet long, 146 feet thick at the base, 389 feet high.

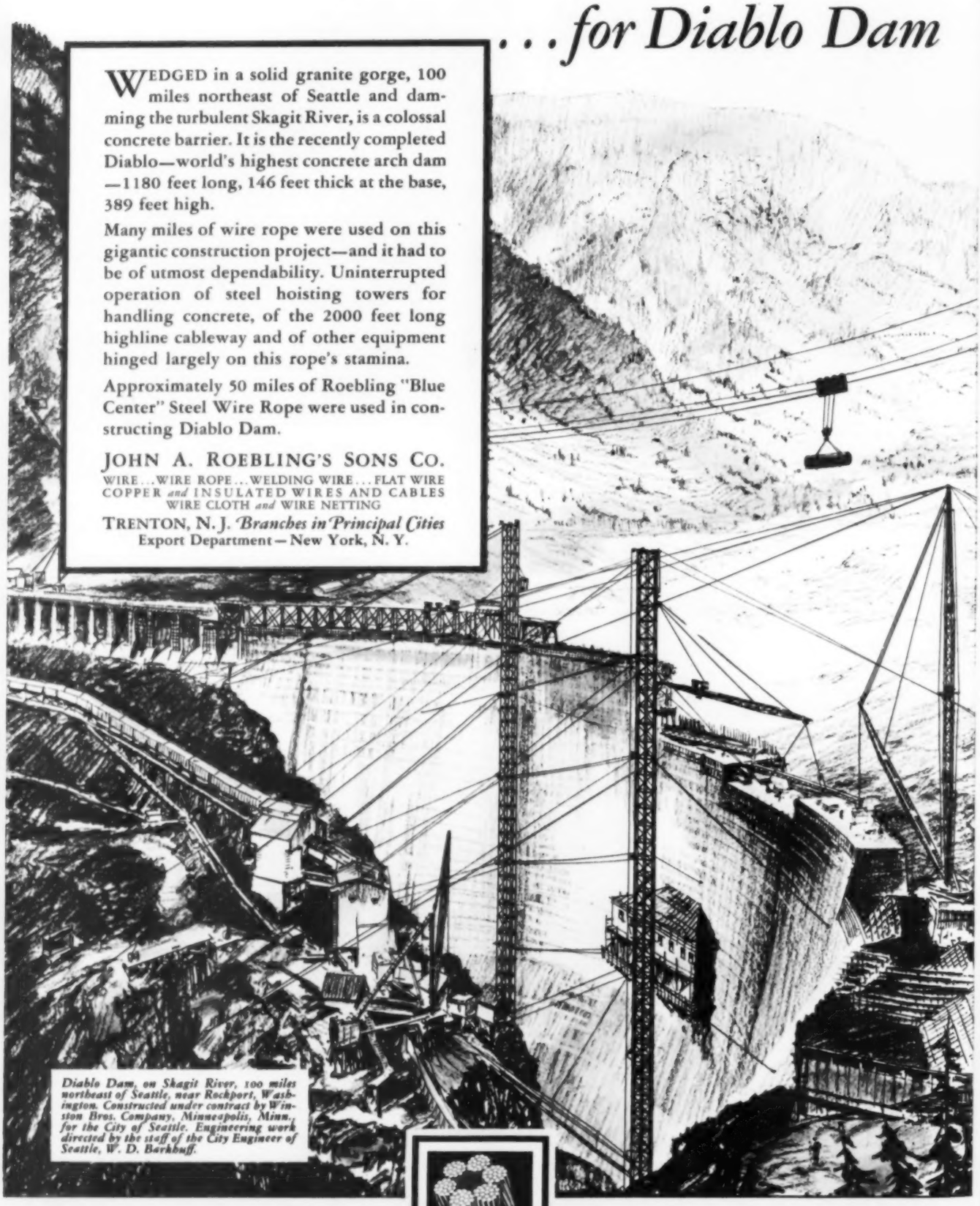
Many miles of wire rope were used on this gigantic construction project—and it had to be of utmost dependability. Uninterrupted operation of steel hoisting towers for handling concrete, of the 2000 feet long highline cableway and of other equipment hinged largely on this rope's stamina.

Approximately 50 miles of Roebling "Blue Center" Steel Wire Rope were used in constructing Diablo Dam.

JOHN A. ROEBLING'S SONS CO.

WIRE . . . WIRE ROPE . . . WELDING WIRE . . . FLAT WIRE
COPPER *and* INSULATED WIRES AND CABLES
WIRE CLOTH *and* WIRE NETTING

TRENTON, N. J. *Branches in Principal Cities*
Export Department — New York, N. Y.



Diablo Dam, on Skagit River, 100 miles northeast of Seattle, near Rockport, Washington. Constructed under contract by Winston Bros. Company, Minneapolis, Minn., for the City of Seattle. Engineering work directed by the staff of the City Engineer of Seattle, W. D. Barkhuff.

ROEBLING WIRE ROPE

"BLUE CENTER" STEEL

Here is a train of 5 Baker Maney 1½ yard Scrapers on a road job — 7½ yards going to the dump in one trip.

Consider This Low Cost Method of Earth Moving

"The Original Self-Loading Scrapers"

Model DR—1½ cu.yd.
Model KR—1 cu.yd.
Model H — ¾ cu.yd.

Think of a single outfit that digs, loads, hauls, dumps, spreads and compacts the dirt. You are getting rock-bottom earth moving costs when single Baker Maney trains move as high as 600 to 700 yards a day with only two or three men. Figure your labor cost—usually less than two cents a yard.

You can depend on long service—years of continuous hard usage—with Baker Maney Scrapers. (Many of them are in use after ten to fifteen years.) Repairs are ridiculously low.

Fit them to your haul or conditions. Use any number of scrapers up to six. You can take off one or add one. It's only a matter of minutes. They'll go where your tractor goes—in close quarters—turn entirely around in a 20-ft. space.

Remember Baker Maneys are practical machines—proven so for twenty years. Baker Maney users almost invariably re-order. With the latest improvements including Timken Roller Bearings, they are clearly in a class by themselves.

Catalog No. 295 tells about many ways to use Baker Maneys profitably. Send for it.

Effect Big Savings With These Baker Products

BAKER BULLDOZERS

Powerful hydraulic-type Bulldozers built along new lines. High lift. Operate well below tractor tracks. Nothing attached to tractor drawbar. Built in models for both Caterpillar and Monarch Tractors.

BAKER ROAD ROOTER

The ideal tool for breaking up tough soils and old pavements. Unusually strong. Points quickly adjusted for depth. Use it on your grading jobs and save wear and tear on your equipment.

The Baker Mfg. Co., 568 Stanford Ave., Springfield, Ill.

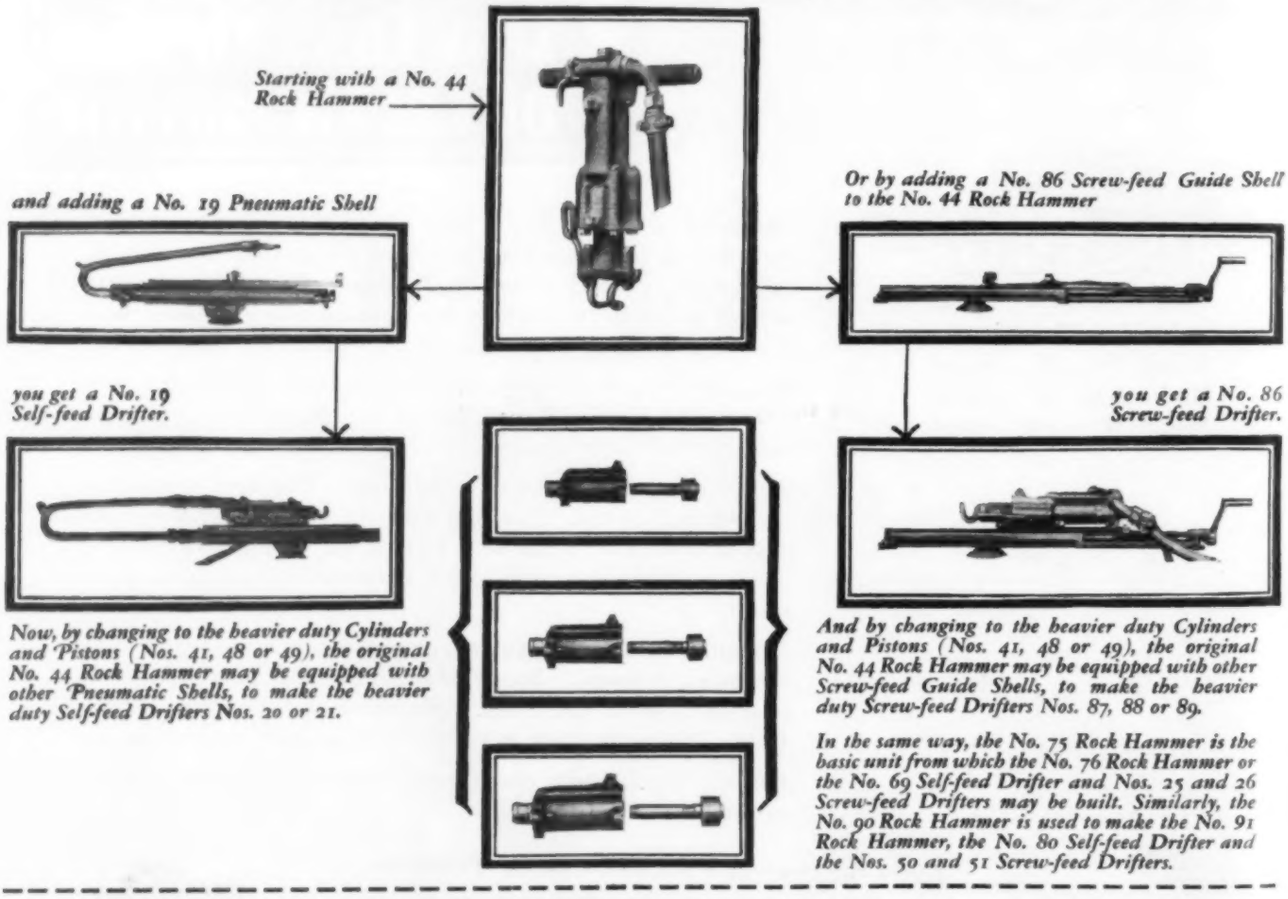
BAKER TRACTOR EQUIPMENT
EARTH MOVING-ROAD MAINTENANCE-SNOW REMOVAL

Please give below the names and models of tractors you own:

Please send literature and prices on
Baker Maney Scrapers ☐ Baker Bulldozers ☐
Baker Road Rooters ☐ Baker Rotary Scrapers ☐
Name .....
Address .....
68

Flexibility...

One of the most important modern developments in rock drill design is the Worthington-Gilman feature of interchangeability of parts . . . making it possible for the user to build up, *on the job,* units of varying size and capacity to meet changing conditions. Here is a graphic picture showing a typical example of the flexibility which distinguishes Worthington-Gilman Rock Drills.


Starting with a No. 44 Rock Hammer
and adding a No. 19 Pneumatic Shell
Or by adding a No. 86 Screw-feed Guide Shell to the No. 44 Rock Hammer
you get a No. 19 Self-feed Drifter.
you get a No. 86 Screw-feed Drifter.

Now, by changing to the heavier duty Cylinders and Pistons (Nos. 41, 48 or 49), the original No. 44 Rock Hammer may be equipped with other Pneumatic Shells, to make the heavier duty Self-feed Drifters Nos. 20 or 21.

And by changing to the heavier duty Cylinders and Pistons (Nos. 41, 48 or 49), the original No. 44 Rock Hammer may be equipped with other Screw-feed Guide Shells, to make the heavier duty Screw-feed Drifters Nos. 87, 88 or 89.

In the same way, the No. 75 Rock Hammer is the basic unit from which the No. 76 Rock Hammer or the No. 69 Self-feed Drifter and Nos. 25 and 26 Screw-feed Drifters may be built. Similarly, the No. 90 Rock Hammer is used to make the No. 91 Rock Hammer, the No. 80 Self-feed Drifter and the Nos. 50 and 51 Screw-feed Drifters.

WORTHINGTON PUMP AND MACHINERY CORPORATION, Harrison, N. J. Date.....

Gentlemen: You may send me literature on Worthington-Gilman Rock Drilling Equipment as follows:

.....

You may send me literature on other Worthington Equipment as follows:

.....

☐ You may send a representative to discuss our problems.

Name _____ *Position* _____

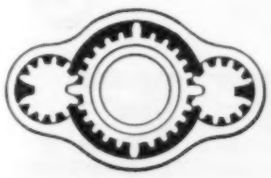
Company _____

B

Address _____

in Rock Drills

and Balanced Independent Motor Rotation



Balanced Independent Rotation
Powerful, Sturdy, Compact

THE Worthington-Gilman Line of Rock Drills possesses advanced engineering features which result in economies and performance abilities heretofore unknown, and which literally place it beyond competition.

1. One of the fundamental principles underlying Worthington-Gilman design is the provision for a general interchangeability of parts. Basic units may be combined with parts of varying size and capacity to make up a broad range of equipment with a minimum investment. This flexibility can be obtained in no other line of rock drills.

2. In Worthington-Gilman Drills, the drill steel is rotated by a balanced motor, automatic but operating independently of the action of the piston hammer. This *"free hammering"* feature makes it easy to free the drill steel, eliminates complicated mechanism and results in more effective drilling and long life. It too is available only in Worthington-Gilman Drills.

This equipment offers the greatest spread of types and sizes on the market. Whatever the rock drilling job, there is a Worthington-Gilman unit that will handle it.

Among users, these drills have earned a reputation for standing up under the severest service, and for producing a maximum of hole footage per day.

Companions to the drilling equipment are the Worthington-Gilman Drill Steel Forging Furnaces and Automatic Heat Treating Machines . . . providing the means to maintain an uninterrupted supply of properly tempered drill steel.

Investigate the Worthington-Gilman line by calling upon the nearest Worthington office for literature or a practical demonstration. *Just fill in and mail the coupon on the opposite page.*

PUMPS *All Sizes...All Types* *For All Services* *Any Capacity...Any Pressure*	COMPRESSORS *Stationary and Portable*
CONDENSERS and Auxiliaries	ROCK DRILLS
DIESEL ENGINES	AUTOMATIC HEAT TREATING MACHINES FOR DRILL STEEL
GAS ENGINES	FORGING FURNACES FOR DRILL STEEL
FEEDWATER HEATERS	DRILL STEEL
WATER, OIL and GASOLINE METERS	ACCESSORIES
MULTI-V-DRIVES	CHROMIUM PLATING

Literature on request

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WORTHINGTON T-3

just published!

Second Edition

Revised and Enlarged

Here is a practical manual needed by every man who has to estimate building construction costs. It gives principles and methods for calculating a price that will approach the actual cost of doing the work as closely as is humanly possible. In this new second edition it has been thoroughly revised and enlarged to cover the new equipment and processes made available to the builder in the past few years.

Estimating Building Costs

by CHARLES F. DINGMAN
Architectural Engineer

277 pages, 23 illustrations, 138 tables, pocket size, flexible, $2.50.

THIS new book now covers everything the estimator need know in order to work on modern building projects. Every branch of construction work is covered, from excavating to interior finishing. The book shows how to analyze the construction job, apply cost data adjusted to existing conditions and to get accurate costs for materials, labor, haulage, overhead, equipment, etc. Over 130 tables are included.

This second edition has been revised to cover new conditions in the building field. Among the more important of these are:

—almost complete motorization of haulage
—increasing use of power shovels and other types of excavating machinery
—use of portable saws, drills and other small tools to perform operations formerly done entirely by hand
—use of the "cement-water ratio" as a means of specifying the proportions of material in concrete

The book includes so many practical suggestions, so many reminders of things to watch out for, and so many valuable special points that both the experienced estimator and the beginner will find it invaluable.

CHAPTER HEADINGS

1. Introduction. 2. Excavating, Grading, Bracing, Hauling. 3. Brickwork. 4. Stone Work, Cement Block Work, Architectural Terra Cotta. 5. Fireproofing and Fireproof Construction. 6. Plain and Reinforced Concrete. 7. Timber Framing. 8. Boarding, Planking, Shingling. 9. Finished Carpenter Work. 10. Structural Steel and Iron Work, Steel Sash. 11. Lathing, Plaster, Stucco. 12. Painting and Paperhanging. 13. Roofing and Sheet Metal, Dampproofing and Waterproofing. 14. Interior Marble, Tiling and Terrazzo. 15. Foundation Work. 16. Cement Gun Work. 17. Short Cut Methods of Estimating. 18. Summary.

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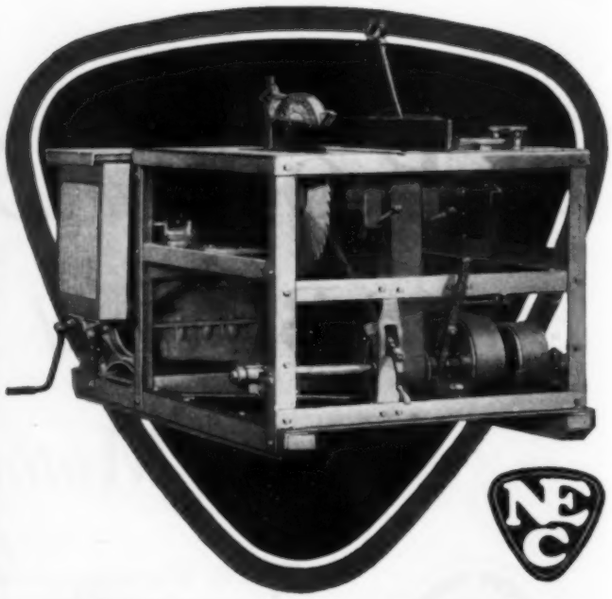


C.H.&E.

No. 14 Saw Rig

A HEAVY duty power tool developed to meet the requirements of the large contractor and concrete builder.

It is fast ripping and has a separate crosscut saw with swinging arbor, allowing two men to use this outfit at the same time.

A four-cylinder 15 H. P. engine (manufacturers' rating) provides ample power.

Other sizes and combinations to meet your needs.

The C. H. & E. line of Saw Rigs is scientifically designed — built to give fast, long service!

Whatever your need, write for C. H. & E. bulletins.

National Equipment Corporation

N. 30th St. & W. Concordia Ave., Milwaukee, Wis.

A 6262-½

. . . . FOR BIG LOADS, HEAVY LOADS, YOU NEED HEAVY-DUTY TRUCKS

Dodge Trucks like this one are carrying capacity loads daily for contractors everywhere

For heavy-duty hauling in your industry you need trucks that will haul heavy loads. » » Dodge Heavy-Duty Trucks will do that. They are rugged in design and construction through and through. Everything about them says *heavy duty*. Everything about them says *power*, says *dependability*, says *long life at low cost*. » » Whatever your heavy-duty hauling needs may be . . . whether you must head up steep hills often or over unimproved roads daily . . . there is a Dodge Heavy-Duty Truck for your job. A Dodge Truck that's modern. That's precision-built throughout and correctly balanced part to part for longer life. A truck that's dependable. That's economical. That will work for you and earn for you as no other truck will do. » » See your Dodge Brothers dealer. See and test the Dodge Heavy-Duty Truck that fits your needs. You can buy it complete with standard or special body. You will find it an exceptional value—a loyal worker, a consistent earner.

THE COMPLETE LINE OF DODGE TRUCKS RANGES IN PAYLOAD CAPACITIES FROM 1,200 TO 11,175 POUNDS—PRICED, CHASSIS F. O. B. DETROIT, FROM $435 TO $2695, INCLUDING THE 1½-TON CHASSIS AT . . . $595

TO HELP LOWER YOUR HAULING COSTS
OPERATING RECORD BOOK FREE

DODGE BROTHERS CORPORATION A-8
Detroit, Michigan

Send your Operating Record Book. I understand there is no obligation.

NAME_____

ADDRESS_____

CITY_____ STATE_____

Number of Trucks Operated *(Book for each will be sent)*_____

DEPENDABLE
DODGE TRUCKS

Save Money

by using

GELEX

GELEX No. 1 GELEX No. 2 GELEX A

These du Pont dynamites have already reduced blasting costs in mining iron, lead, zinc, molybdenum, limestone, gypsum and clay in quarrying limestone, granite and trap rock in excavating for railroad and bridge construction and in driving railroad and sewer tunnels

• •

DYNAMITES of the Gelex type are designed expressly to decrease the cost of blasting in work that has been done heretofore with ammonia gelatin ranging from 35 to 60 per cent strength or with 40 or 60 per cent high density ammonia dynamite.

They will *not* give as good results as these older explosives in *every operation*—much depends upon local conditions—but *Gelex has lowered costs in many operations.*

Gelex No. 1 and Gelex No. 2 stand between low density ammonia dynamite and gelatin dynamite —more cohesive and much more water resisting than ammonia dynamite but bulkier than gelatin. Gelex No. 1 averages 105 cartridges, 1¼ by 8 inches, to the 50-pound case; Gelex No. 2 averages 120 cartridges. No. 1 has a bulk, or cartridge, strength of 60 per cent; No. 2 of 45 per cent. Both are adapted for underground as well as open work.

Gelex No. 1 has thus far found its chief usefulness in well-drill holes in limestone quarries.

Gelex No. 2 has been most successful as top load in well-drill holes in quarrying; as entire load in well-drill holes for excavating shale; in smaller

diameter holes in bench or low face limestone and gypsum quarries; and in limestone, gypsum, clay, lead, zinc and iron mines.

Gelex A has much the same characteristics as 60 per cent ammonia gelatin but is of slightly lower velocity and lower density, averaging 99 cartridges, 1¼ by 8 inches, to the 50-pound case. It is plastic and water resisting and gives off a relatively small volume of harmful fumes. Gelex A has proved an efficient substitute for 60 per cent ammonia gelatin for blasting limestone, granite and trap rock in quarrying and in excavating for construction work; for driving tunnels in sandstone and limestone; and for mining iron ore. At present this explosive is offered for sale only east of the Rocky Mountains.

If you think Gelex is adapted to your mining, quarrying or contracting requirements, tell us the conditions. Our extensive experiences may enable us to apply Gelex as a means to solve your problems.

DU PONT

REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., Inc. Explosives Dept. Wilmington, Delaware

5 REASONS WHY—

CHAIN CROWD IS BETTER—

1. Can crowd with full engine power, independent of hoist.
2. Chain crowd is POSITIVE. Permits vigorous shaking of bucket and fast, positively controlled reverse crowd action . . . Greater working range.
3. Crowd chain lasts for years in normal service.
4. Chain crowd costs manufacturers more, but saves users hundreds of dollars yearly in lost time and repair expense.
5. When chain crowd or cable crowd is optional, the price of the chain crowd machine is usually higher because, in the final analysis, price is a true index of value.

Four years ago, we discarded cable crowd for these reasons. All Bay City machines are equipped with chain crowd only. The Bay City *patented crowd chain adjustment* permits any change in the boom angle without stopping to disconnect or adjust the chain length. Investigate!

Other BAY CITY Features:

Model-R, shown here, is a 26-ton full revolving, ¾ yd. convertible crane, dragline, trencher, skimmer, etc. The wide 76-in. dia. roller path gives unusual stability. The crowd clutch and reverse crowd clutch are both "E-Z" control operated. Ball bearings on all main shafts. Propelling unequalled for ease or steering. *Other models from ⅜ yd. to full size 1 yd.*

BAY CITY SHOVELS, Inc.

EASTERN OFFICE—
9 Westfield Ave., Roselle Park, N. J.

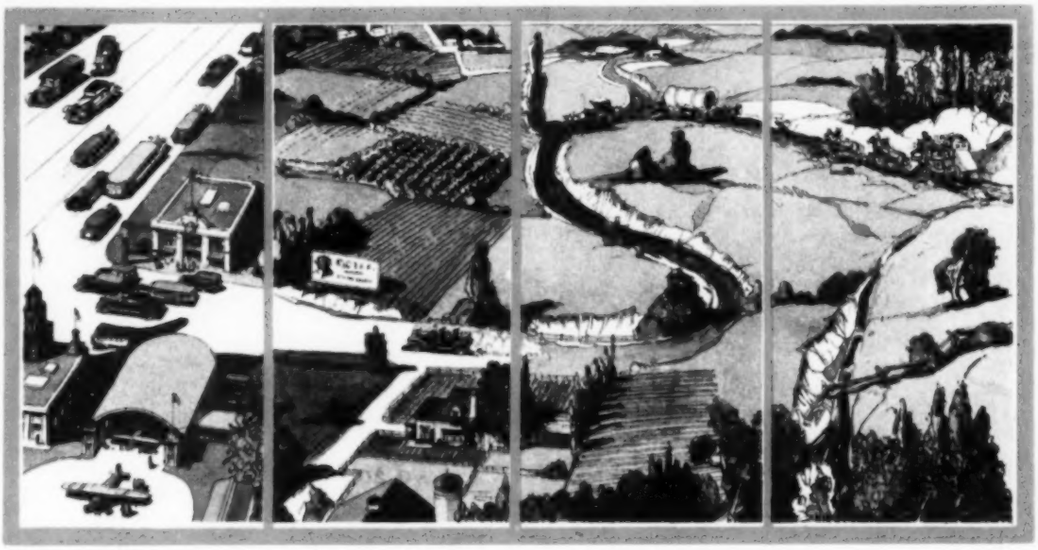
BAY CITY, MICH.

BAY-CITY SHOVELS

THE BAY-CITY FAMILY OF FAST WORKERS

Lessons learned *down through the years*

for the benefit of Today's Road Builders



Some manufacturers of road machinery are constantly able to so improve their products, through their background of experience, superior manufacturing facilities and high calibre of engineering talent, that their machines actually make substantial contributions to the technique of building and maintaining the nation's roads. The complete line of Austin-Western Road Machinery is such equipment.

Today, better roads are being built at a steadily decreasing cost per mile because the men who make Austin-Western Road Machinery have the advantage of *experience in roadworking methods accumulated down through the years*—Lessons learned carving new roads out of wilderness trails. Lessons learned maintaining older roads, year after year, under ever-increasing streams of traffic. Lessons learned as great new highways crisscross the continent.

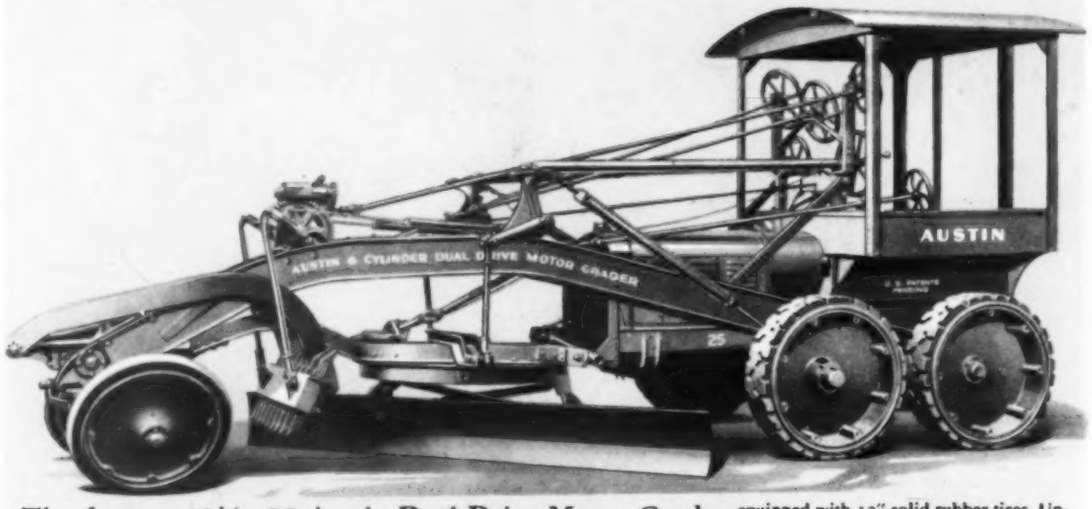
When you select Austin-Western Road Machinery the *practical benefits* of this accumulated experience are available for your work.

AUSTIN-WESTERN ROAD MACHINERY COAST TO COAST

Austin-Western
ROAD MACHINERY

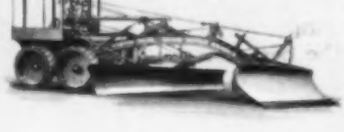
AUSTIN-WESTERN ROAD MACHINERY COAST TO COAST

You will find the machine you need in the *complete* Austin-Western Motor Grader Line



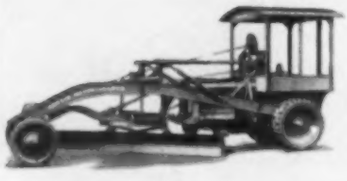
The famous 12½—25 Austin Dual Drive Motor Grader equipped with 12" solid rubber tires. Unlike most motor graders, this machine has a 6-cylinder motor instead of being built around a standard tractor. It has far more power than an ordinary maintenance machine. 12" tires on all four drive wheels give enough ground contact to utilize the full power of the motor.

The 12½—25 equipped with pneumatic tires, including dual pneumatics on the four drive wheels.

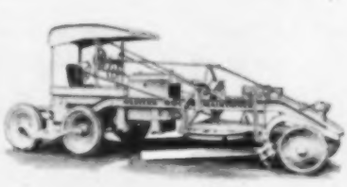


Model "20" Austin Dual Drive Motor Grader with Special Snow Plow Equipment.

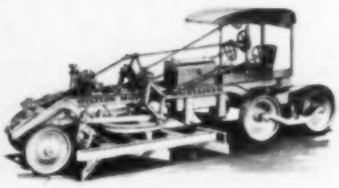
Model "20" Austin Dual Drive Motor Grader equipped with crawler tread.



The Austin Model "20" Single Drive Motor Grader.



The Western Motor Maintainer with blade and scarifier attachment.



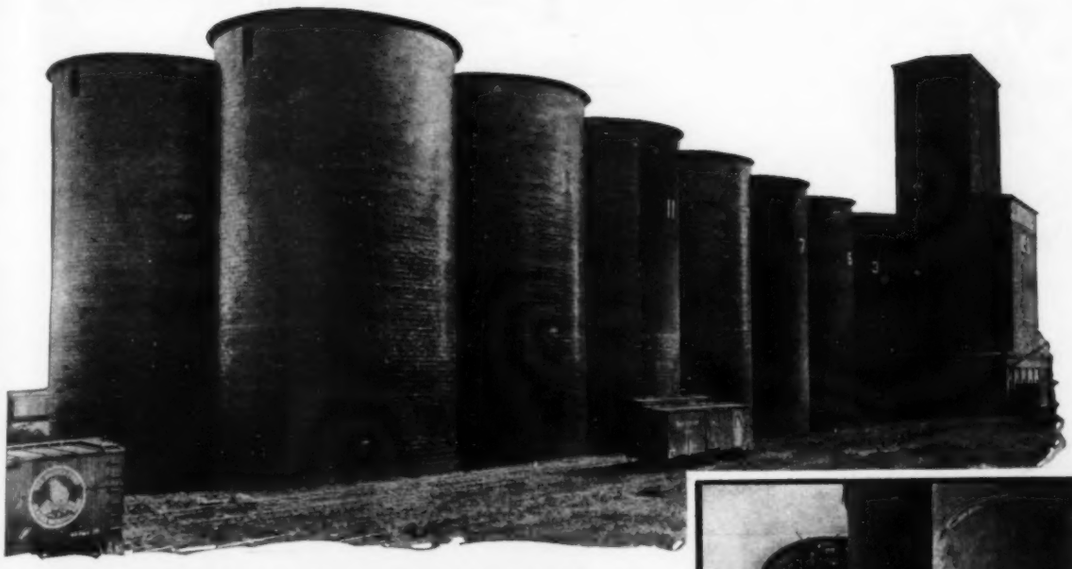
The Western Motor Maintainer with solid steel drag attachment.

The A-W Motor Grader line is most complete in every respect. It is made up of a wide variety of units, each with characteristics to suit individual preferences or to meet special conditions. It includes graders powered by a number of widely known power plants as well as completely factory-built models with operating features not possible when standard tractors are used. Write for complete information—now.

THE AUSTIN-WESTERN ROAD MACHINERY CO.

400 North Michigan Avenue • CHICAGO, ILLINOIS • *Branches in principal cities*

Leaning Wheel Graders, Straight Wheel Graders, Motor Graders, Elevating Graders, Crawler Dump Wagons, Scarifiers, Rock Crushers, Portable Conveyors, Rollers, Motor Sweepers, Street Sweepers, Sprinklers, Road Oilers, Hot Patch Portable Asphalt Plants, Plows and Scrapers.



Workhouse and hollow tile tanks, Central Elevator Co. plant, Peavey Grain Co., Minneapolis. Originally coated with "cut-back" asphalt, which produced rough surface and poor protection. Now completely refinished with Headley Emulsified Asphalt No. 11 and cracks also covered with Headley Asphalt Saturated Cotton Fabric. Tanks 3 and 5 and a portion of 11 had been so finished when photo was taken. Note improvement in surface smoothness.

Potection for grain tanks, silos, other tanks and their contents

TO seal surface pores effectively, to prevent surface disintegration, and to stop infiltration of moisture at existing cracks in concrete, hollow tile, brick or stone structures of this type, Headley Emulsified Asphalt, reinforced if necessary, at the larger openings with Headley Asphalt Saturated Cotton Fabric, is the best finishing or maintenance treatment that money can buy. Simple *cold* spray or brush application, the uniform spreading and bonding over clean moist or cold surface at any temperature above 35 deg. F., the purity and ductility of the asphalt deposit, and the freedom of the finished coating from porosity, checking and cracking, all contribute to efficient low-cost protection. Once set, Headley Emulsified Asphalts never reemulsify, but remain thoroughly impervious throughout exceptionally long life.

HEADLEY
Emulsified
ASPHALTS
REG U S PAT OFF

Write for literature or consult catalog pages in Sweets, A.S.M.E. Mechanical, and Chemical Engineering Catalogs. Ask for standard specifications, and Engineering advice.

Headley Emulsified Products Company

Emulsified Asphalts for Industrial Uses
Largest Manufacturers since 1908.

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New York, Chrysler Bldg. Chicago, One LaSalle St. Bldg.
Works, Marcus Hook, Pa.

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Altoona	Des Moines	Milwaukee	Peoria	Syracuse
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Baltimore	Erie	Mobile	Pittsburgh	Toledo
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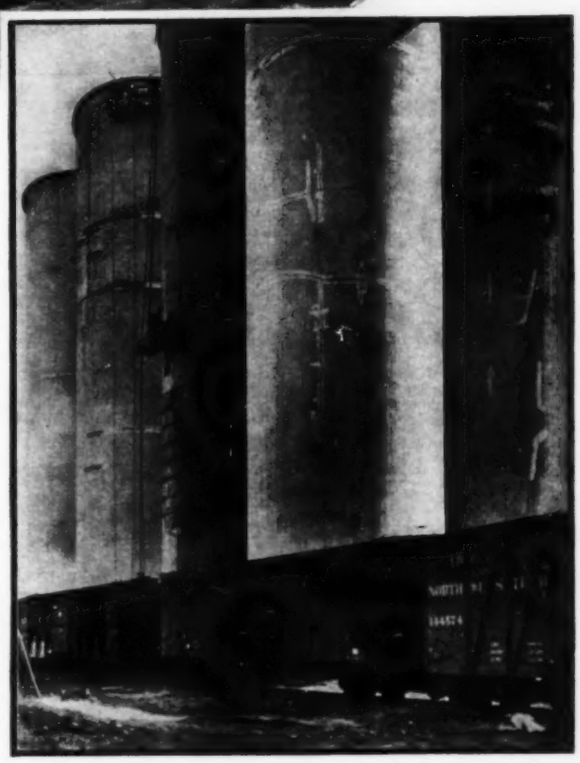

At another Minnesota plant, cracks in the above grain tanks let in moisture that damaged the contents and threatened gradual destruction of the concrete walls. Repair with a putty composition covered with aluminum paint proved ineffective.

Complete protection through durable sealing of all openings was accomplished by applying a first heavy coat of Headley Emulsified Asphalt, then a second, then imbedding strips of Headley Asphalt-Saturated Cotton Fabric and finally covering with a third coat of Headley Emulsified Asphalt.

Applicators for both jobs shown, L. N. Sickels & Co., St. Paul.

Mail this coupon for free sample

HEADLEY EMULSIFIED PRODUCTS CO.,
Franklin Trust Building, Philadelphia.

Please send Bulletin 330 and free sample of Headley Emulsified Asphalt.

Name and official position .....

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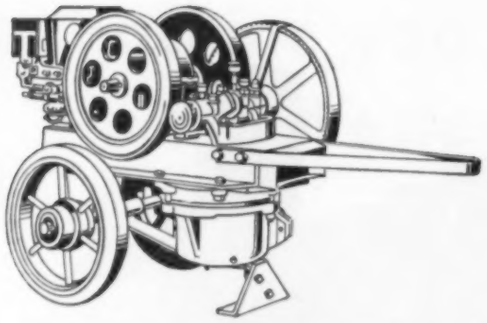
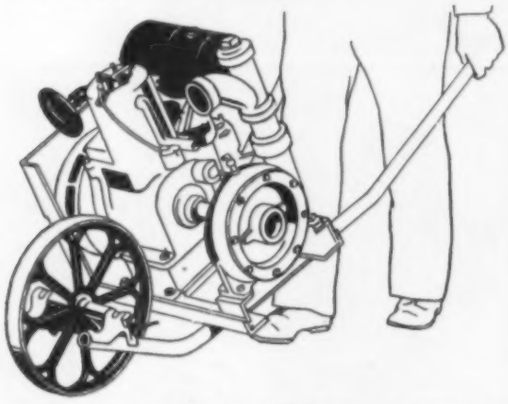
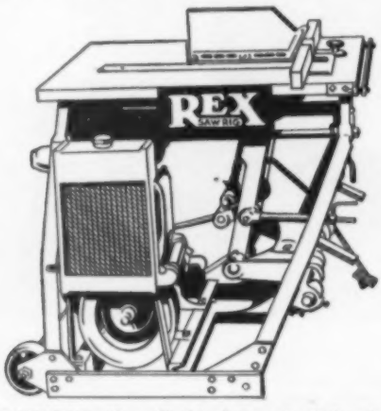
Cons. Meth. 5-31



REX 3" DIAPHRAGM—Another super value on a new idea—Weighs but 525 lbs., that's 250 below the average—Measures but 30" high, 29" wide, 42" long—But handles 6500 g.p.h. on 7' lift at sea level—The only 3" pump with famous 9-minute diaphragm change—1½ h.p. engine—Long-life diaphragm—Price with steel wheels, only $175.00 f.o.b. Milwaukee.



REX WATER BOY—World's lightweight champion—A 2" Centrifugal with ball bearing impeller—Only 23" wide—Weighs but 300 lbs.—Mounted for one-man handling anywhere—Maximum capacity 9300 g.p.h.—Will handle heads up to 50 ft.—1½ h.p. self-oiling, air-cooled engine—But price is only $170.00 f.o.b. Milwaukee.



REX No. 3 SAW RIG—Home Builders' Special—Only 28" wide—wheel-mounted—45 degree tilting table—Improved saw guard—Handles dadoing, mitering, beveling, double-mitering, etc.—3 h.p. self-oiling engine, radiator cooled—Electric motor if desired—Blade cuts off in straight line—no arc. With gasoline engine, $275.00 f.o.b. Milwaukee.

REX

CONSTRUCTION EQUIPMENT

REX Mixers—Pumps—Saw Rigs—Plaster and Mortar Mixers—Pavers—Complete Concrete Factories—Moto-Mixers—Moto-Agitators—Moto-Remixers—Elevators—Conveyors.

YOUR pockets, and especially the money that's in them, will be interested in this advertisement.

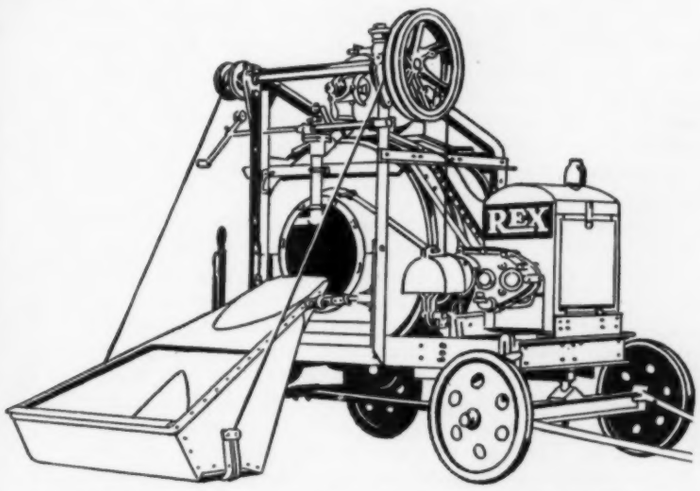
Rex Pumps, Mixers, Saw Rigs and other machines are designed, built and priced to give you more for fewer dollars.

Giving you more for less gives Rex greater volume. Such increased volume means lower manufacturing costs.

In other words, Rex actually can give you more for your money. So we don't have to sell Rex with loud, boastful statements. We let Rex Machines sell themselves by the way they're designed—the way they are built—the way they perform—the astonishing way they are priced. Make any comparisons you wish

Your Pockets

PLASTER-MORTAR MIXER—Home Builders' Special—Handles any stucco, plaster or mortar, with or without hair—Sealed bearings—Criss-cross mixing—better batches in less time—Adjustable, hardened scrapers—High-carbon steel paddles—6 cubic ft. capacity—Spring-mounted axle and rubber-tired wheels, only $390.00 f.o.b. Milwaukee.



REX 7-S MIXER—Shimmy skip—All-Steel drum—Steel drum rollers—Timkens—Enclosed, in-oil, cut-gear transmission—7-second skip—7-second discharge—Only 93 inches long—Weighs 500 lbs. less—End controls—Skip knockout—Automotive clutches—But only $805.00 with Le Roi Engine and steel wheels, f.o.b. Milwaukee.

with any other machines. You be the judge. The latest Rex Book called *"That Men May Build Better, Faster, Cheaper"*—tells in facts and figures what Rex Pumps, Mixers, Saw Rigs and similar machines are and do. Ask for a copy with this coupon—in the interests of your pockets.

CHAIN BELT COMPANY, **Cable Address: Beltchain**
1664 West Bruce Street, Milwaukee, Wisconsin

"That Men May Build Better, Faster, Cheaper." This coupon brings a copy of this book which tells the story in cold, hard figures and facts what these Rex Machines are and do:

☐ Diaphragm Pumps ☐ Centrifugal Pumps ☐ Self-Priming Centrifugals
☐ Plunger Pumps ☐ Road Pumps ☐ Tilting Mixers
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Address .....

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Also Concrete Factories and Moto-Mixers, Paving Mixers

. . . THE SUN GOES DOWN BUT THE WORK GOES ON

Model EH Kohler Electric Plant—1½-K. W. 110-volt D. C.

Kohler Light makes it possible to work with night shifts

No WASTE of time where Kohler Electricity is on the job! Night after night—week after week the contractor using Kohler Electric Plants is able to work extra shifts.

Kohler Electric Plants furnish electricity for light and other uses around excavating, dredging, building and other outdoor engineering jobs. Sturdy, self-contained, compact and easily transported—these units furnish electric current and light for night work whenever you want it. No storage batteries are necessary. Current comes direct from the generator. Gasoline serves as fuel.

Kohler Plants generate current at 110 or 220 volts A. C. or D. C. Capacities range from 800 watts to 10 K. W. Of special interest to contractors is Model EH, a 1½-K. W. 110-volt D. C. plant with metal housing. This plant can be mounted on shovels, dredges, ditchers, pavers, draglines and other construction equipment without crowding the operator. The metal housing which encloses the entire plant, including the gasoline-tank, protects engine and generator from the elements. The controls are on the outside and the plant can be operated without raising the hood.

A Kohler Plant is an important item of equipment wherever public electricity is not practical. Send coupon for booklet describing details. Kohler Co. *Founded* 1873. Kohler, Wis.—*Shipping Point*, Sheboygan, Wis. — *Branches in principal cities*. . . . Manufacturers of Kohler Plumbing Fixtures.

KOHLER OF KOHLER ELECTRIC PLANTS

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Gentlemen: Please send catalog describing Kohler Electric Plants.

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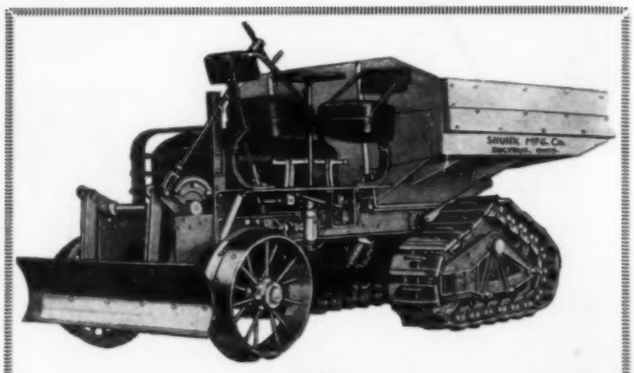

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Gravity

TRACTOR DUMP WAGON

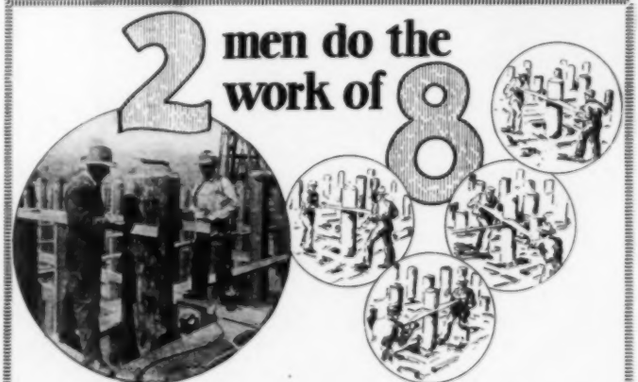
Combines in one heavy duty unit features of Truck, Tractor, Trailer and Bulldozer.

Capacity, 4 Yards.
With sideboards, 5 Yards.

Crawlers, Steel Wheels and Pneumatic Tires all interchangeable on same axle.

Designed and built by
SHUNK MANUFACTURING COMPANY
Established 1854
102 Auto Ave., Bucyrus, Ohio

2 men do the work of 8



—*this faster way of cutting heavy timber*

These dock builders will tell you what they think of Timber Wolf Portable Sawing Machines. Approximately 4,000 timber piles were cut on the dock shown. Two men with the Timber Wolf Saw averaged twenty-five 16 in. to 23 in. old growth yellow fir piles per day—4 to 5 times as many as two men with a hand-saw! Two men doing the work of 8 means profits to you. Write for other interesting Timber Wolf figures.

A.C. or D.C. drive, or Compressed Air drive for underwater service.

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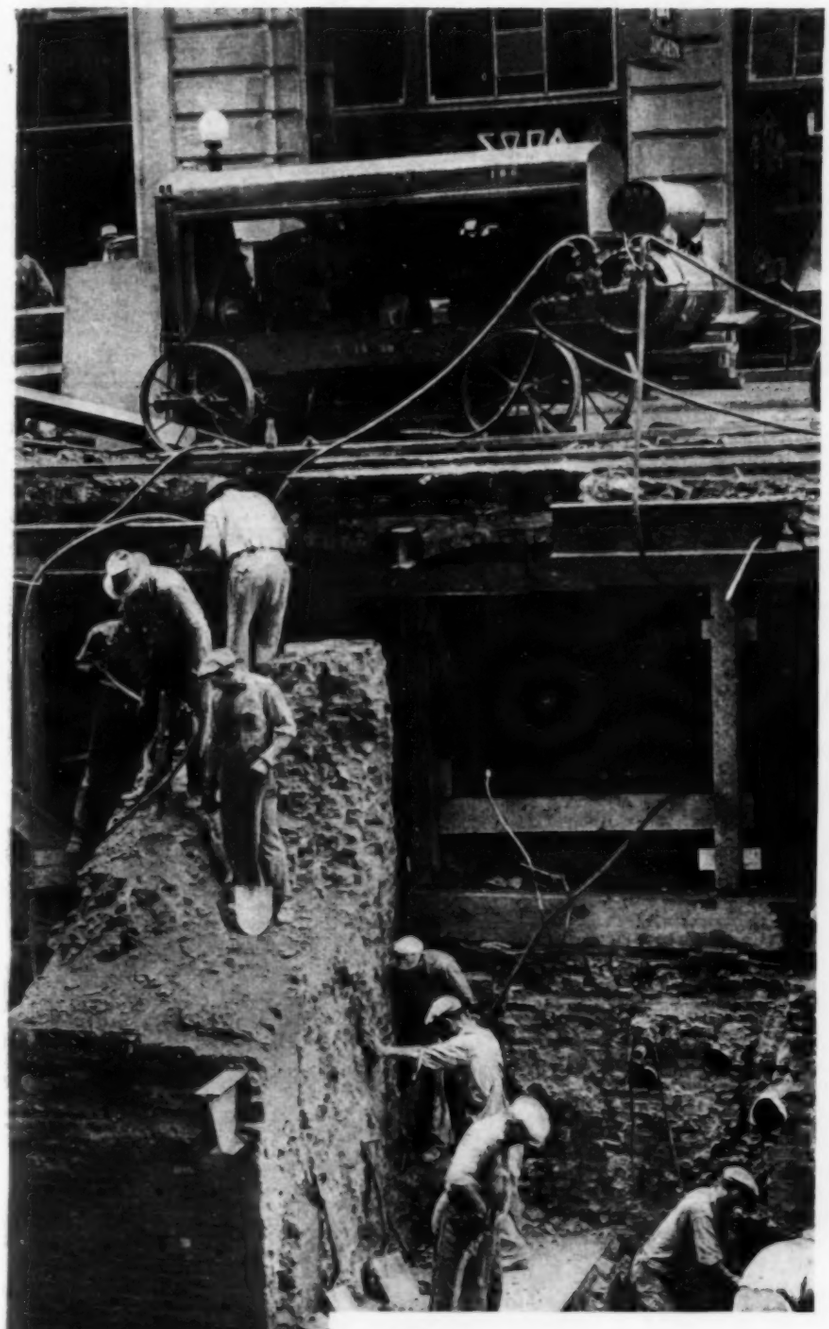
IT'S A Schramm...



... a big No. 360 operating five pavement breakers on building excavation job at Newark, N. J.

Give 'em the air and five good paving breakers can rip out an enormous quantity of masonry such as this.

That's why the No. 360 Schramm is becoming more and more popular with contractors everywhere. It's a 360 cu.ft. Compressor ... and that means 360 cu.ft. every minute, all day, every day.

Let us tell you all about this hard-hitting Schramm ... and the lighter members of the Schramm family, too. Send for the complete catalog.

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1 man with an "ANCHOR" Puller-jack can do the work of a gang ~

New LOW PRICE $32.00

NEW IMPROVED MODEL

The one-man outfit for pulling, moving, lifting heavy loads. Gives 10,000 lbs. actual pull. Easily handled by one man. Works in any position. Always a use for it to do the odd jobs quicker, easier and cheaper. Does the work of chain hoists, winches, block and tackle, etc.

The tool of a thousand uses. Handles heavy machinery. Pulls sheet piling and lagging. Pulls out stalled trucks. Joins up large pipes Used on erection work and rigging jobs. Spots railroad cars. Pulls ropes, belts and conveyors for splicing. Binds pile clusters. Pulls stumps. Shifts R. R. tracks. For wrecking and felling walls. Stretches cables and guy lines. For moving barges. Pulls out boiler tubes or old buried pipes. Catalogue sent upon request.

New feature permits gradual slackening off of load, or quick release cut-off, as desired. Special length chains can be furnished. If your supply jobber does not stock it, order direct.

For standard outfit f. o. b. factory. Includes 15 foot load chain, 3½ foot tail chain and sheave block. Shipping weight 82 pounds.

Sheave block is used to double pulling power, changing direction, etc.

Shifts forms for concrete work.

A HANDY TOOL ON EVERY JOB; PAYS FOR ITSELF IN A WEEK; ORDER ONE TODAY

Also Manufacturers of "Anchor" Track Braces and "Anchor" Rerailers

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MECHANIZE YOUR MATHEMATICS
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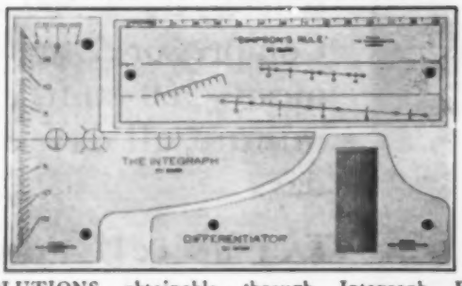
THE INTEGRAPH



SOLUTIONS obtainable through Integraph Equipment are better than theories. Problems set out physically and visually can be grasped, handled to slide-rule accuracy, and interpreted quickly and fully without abstruse calculations.

Structural stresses, bending moment, deflections, shear, volume calculations and many other mathematical determinations involving intricate and laborious calculations become simple thru the mechanical process of "Integraph" equipment. This is explained in our book, "The Mechanics of Calculus."

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SAFETY IN UNDERPINNING
Is assured by use of
WATSON-STILLMAN
Independent Pump Hydraulic Jacks

Accurate—Dependable—Easy to Repair

These Jacks are being used extensively by Underpinning and Foundation Contractors for underpinning work, sinking piles under foundations and making tests of footings.

We make a full line of other types of jacks and also many hydraulic devices suitable to the contractor's needs, such as concrete testing presses, benders, shears, pumps, punches, valves, tunneling shields, etc. ***Write for Catalogs.***

THE WATSON-STILLMAN CO.
114 Aldene Road, Roselle, New Jersey

1, 2 or 3
MATERIALS

1 SCALE
does the work

NO BEAMS
to balance

THE
EFFICIENT
WEIGH
IS

THE HELTZEL WAY

All materials are weighed on one springless dial scale, which automatically registers every pound of total weight. Further, the dial indicator automatically returns to zero when the batch hopper is emptied. Every batch can be weighed, discharged and back-checked without balancing a scale beam or setting counterpoises. This is true even where batches of different sizes are wanted in succession.

Investigate the unusual features of the Heltzel Weighing Plant. Write for a catalog of Heltzel Bins and Agrabatchers.

THE HELTZEL STEEL FORM & IRON CO., Warren, Ohio

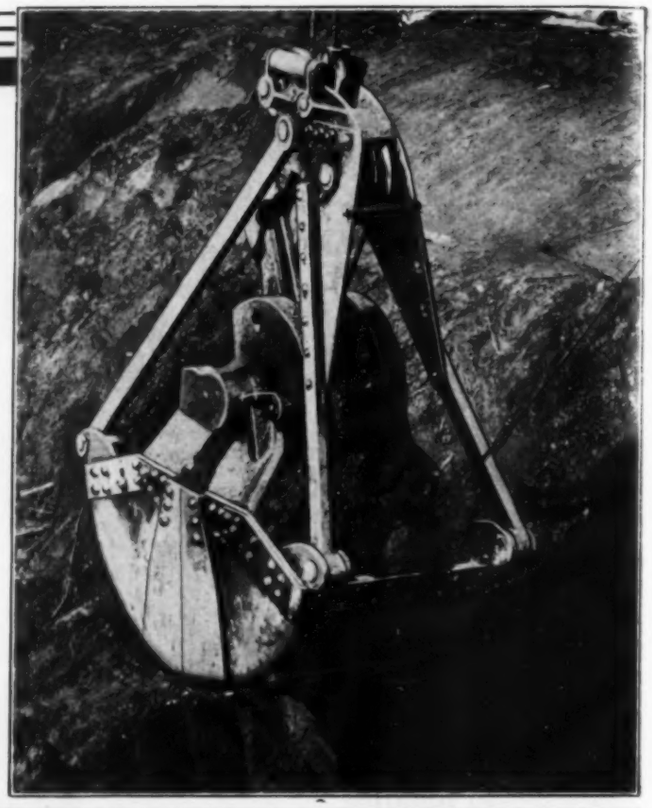
Fabricators of Portable Batching Plants, Stationary Bins, Bulk Cement Plants, Steel Road Forms, Traveling Bridges, Hand Screed, Straight Edges and many other items of Contractors' Equipment.

Dig harder materials!--

with a WILLIAMS "Champion"

GUARANTEED to be *the most powerful and fastest digger built.*

We'll be glad to help you estimate the improvement you can reasonably expect on your excavating, or material handling, with a *Williams* "Champion" Bucket. *Let one prove itself on your work.* Write us.



G. H. WILLIAMS COMPANY
607 Haybarger Lane, Erie, Pa.
Branch Offices: New York, Pittsburgh, Cleveland, Chicago

WILLIAMS
BUCKETS—TRAILERS

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ROGERS TRAILERS

DISTINGUISHING characteristics of Rogers Trailers have always included extreme low loading height, and lightness in proportion to capacity, making possible the movement of the heaviest loads with maximum profit.

Pioneering in design, as well as the use of alloy steel, cast steel wheels and heavy mill type Timken Bearings, Rogers Brothers have always maintained the highest in heavy duty trailers.

ROGERS BROTHERS CORPORATION
106 ORCHARD ST., ALBION, PENNA.

★ Write for Catalog NO.28

MORITZ SHOULDER AND BERM MACHINE

NEWER - BIGGER - BETTER
SPEEDS UP PRODUCTION - CUTS COSTS

- ENGINEERS LIKE IT - CONTRACTORS NEED IT -
USED IN MORE THAN TWENTY STATES

MORITZ-BENNETT CORPORATION
EFFINGHAM, ILLINOIS

Fairbanks Wheelbarrow Scale. Sturdy. Accurate. Light weight for easy transportation. Scale is equipped with 3 beams. One for tare and two ingredient beams. These are protected by the beam housing and available through the door at the back.

WHEELBARROW SCALE ADVANTAGES

1. Provides accurate, scientific control of mix.
2. One scale with 3 beams does work of 2 ordinary scales.
3. Low platform — only 9 inches from ground.
4. Light weight. Easy to handle.
5. Tell-tale device means both speed and accuracy.
6. Strong, sturdy construction. All-steel welded frame and beam box.
7. Complies fully with American Road Builders' Association specifications.

A *better* mix—in *less* time . . . *with these* new Fairbanks Scales

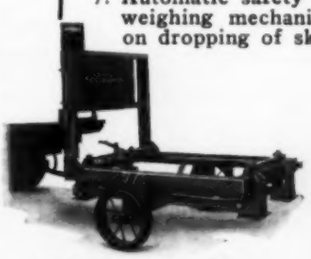
MEET rigid concrete specifications without increasing the labor cost of mixing. Get the same accurate proportioning of aggregates on big jobs and small. You can do it with these new scales. . . Built by Fairbanks especially for concrete mixing.

The Fairbanks Wheelbarrow Scale and the Fairbanks Skip Mixer Scale offer exclusive advantages in control of the mix and in labor saving that will interest every contractor, engineer and architect. Ask your equipment dealer or write us for complete information and prices.

FAIRBANKS, MORSE & CO.
900 S. Wabash Ave., Chicago
And 40 principal cities—a service station at each house.

SKIP-MIXER SCALE FEATURES

1. These scales enable contractors to meet rigid specifications without increasing labor costs.
2. Cut mixing time on every job.
3. Meet standard specifications for scales such as adopted by American Road Builders' Association.
4. Are easily transported.
5. Are of sturdy construction. All-steel welded frame and beam box.
6. Have over-and-under indicator which indicates accurate balance.
7. Automatic safety gear relieves weighing mechanism of shock on dropping of skip.



Fairbanks Skip Mixer Scale mounted on special dolly for towing.

Fairbanks Skip Mixer Scale. Notice the three ingredient beams.

Preferred the World Over

5516-BA-31.3

Fairbanks Scales

"Domestic" Pumps for Contractors

For the Excavating, Sewer, Pipe Line and Bridge Contractor

"Domestic" Automatic Priming Ball Bearing Centrifugal Pump Units

Capacities—150 to 2000 G.P.M.
Heads—up to 65 feet.
Primes—up to 27 feet Suction.
Sizes 2½ - 3 - 4 - 5 - 6 and 8-inch Suction and Discharge.

For the Road Builder

"Domestic" Giant Triplex

500 lbs. Pressure—Ball Bearing, Force Pump Units.
80 to 100 G.P.M. Capacity.
40 hp., 4-cylinder Engine.

For General De-watering Work

"Domestic" Double No. 4 Diaphragm Pump Units

Manifold Suction for one 4-inch Suction line. Self Oiling Jack with Ball Bearings.
Four Cylinder, Radiator Cooled Engine.

DON'T LET THE WATER HAZARD JEOPARDIZE YOUR PROFIT ON THAT EXCAVATION, SEWER, PIPE LINE, BRIDGE OR ROAD JOB—

Get "Domestic" Pumps and Be Safe

Sizes and types for all conditions encountered by Contractors

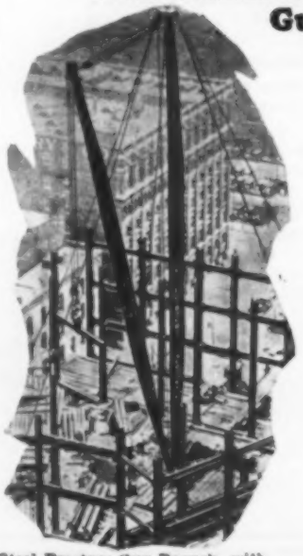
—Write us today for descriptive bulletins—

DOMESTIC ENGINE & PUMP CO., Manufacturers, Shippensburg, Penna.

—Distributors in all principal cities throughout the U. S. A.—

TRADE MARK
DOBBIE
ESTABLISHED 1862

ALL STEEL DERRICKS
Guarantee Safety



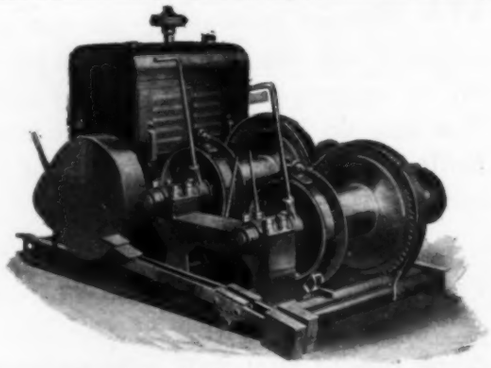
Steel Erectors Guy Derrick, with Ball Bearing Footblock.

When you guarantee safety, you economize—for safety means uninterrupted operation and lowest possible maintenance costs.

And DOBBIE All-Steel Derricks have been designed for safety and consequent economy. You need assurance of dependable safety for continuous performance. SAVE POWER BY USING BALL OR ROLLER BEARING FOOTBLOCKS AND SHEAVES. Built in both Guy and Stiff Leg types. Write for information and prices.

Bulletin D-9 fully describes these derricks

DOBBIE FOUNDRY & MACHINE CO.
Niagara Falls, N. Y.
Wire Rope Sheaves—Blocks—Hand Winches and Timber Derrick Fittings
Carried in Stock at Niagara Falls and New York City



A BETTER HOIST at a BETTER PRICE

Improved design with modern, electric arc-weld construction enables us to offer a stronger, lighter and more serviceable hoist in the—

DAKE "SLG" type Builder's Hoist

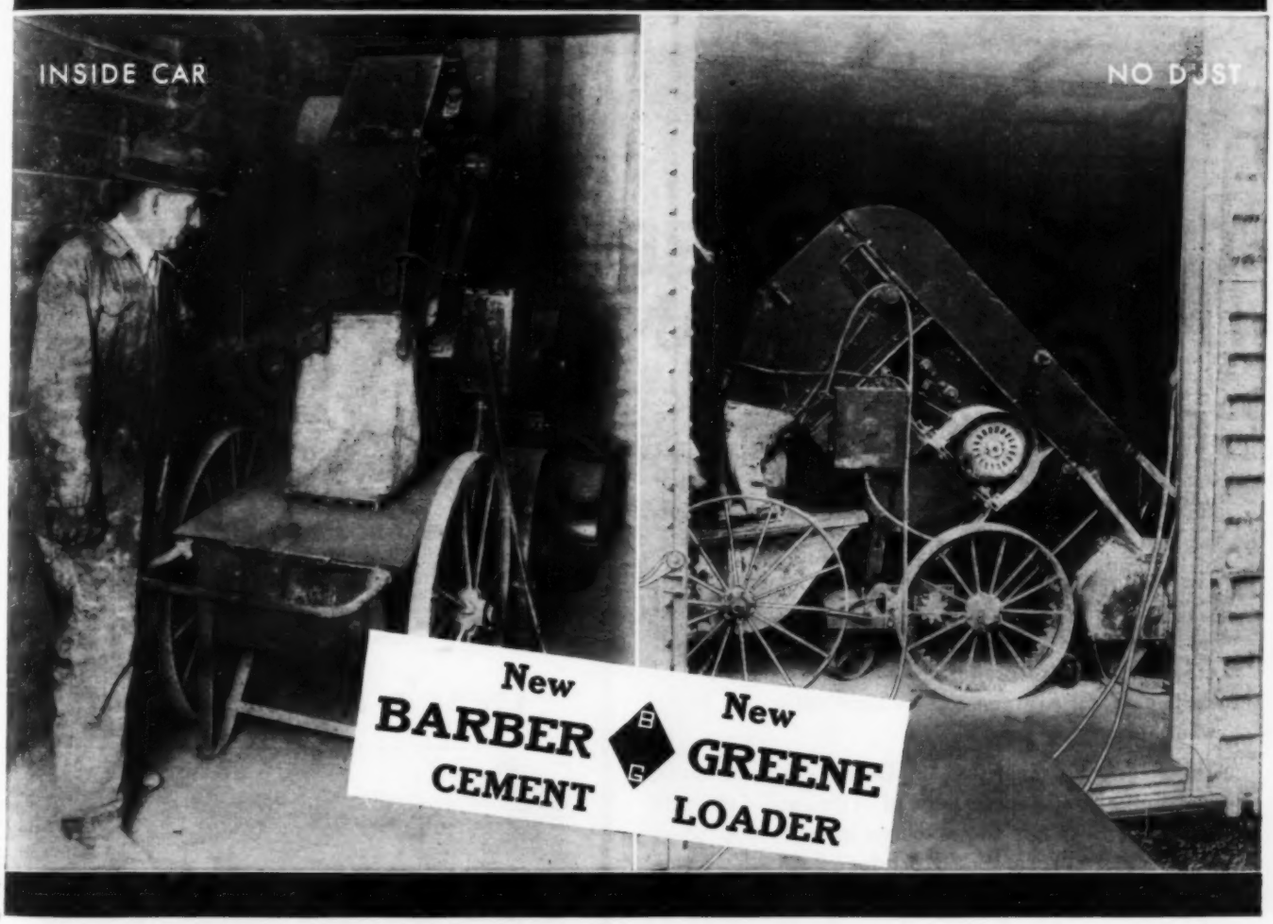
The base-frame, drums, ratchets, and brake flanges are all steel giving greater strength and wearability without excess weight.

Single cone type hard maple frictions, using larger blocks with greater contact surface and end grain, gives maximum frictional power and far outlast the ordinary frictions. Frictions operated by cam thrust with ball bearings carrying the thrust forces, gives easy and positive action.

Write for catalog No. 32 giving details and many other features of this better hoist built in 2 H.P. to 27 H.P. sizes.

DAKE ENGINE COMPANY
Grand Haven, Michigan

Licking a Job That Licks Men



SPECIALIZING IN INVENTING FASTER AND CHEAPER MACHINES AND METHODS

There is hardly need to detail the savings to be gained through the use of bulk instead of bagged cement.

But the nigger in the woodpile has always been handling bulk cement. This is a killing job for men, especially on hot summer days. Yet in many cases the hand labor method has been cheaper than costly unloading equipment—because of the danger of breakdowns, because of the investment required, because of the permanency of the set-up.

To lick the dirty job of handling bulk cement, Barber-Greene invented this new machine: The Cement Loader.

It works with men and barrows or buggies. It often eliminates three or four men from the cement crew. It eliminates the need for shovelers inside the car. It reduces dust to a minimum. It has three feeding speeds and feeds itself into the pile. It provides a loading capacity to buggies and barrows at least double that of the ordinary shovel unloading gang. It is a portable unit, requiring no change in present hand unloading methods. And it asks but a nominal investment. It is electric powered, taking juice from standard outlets or from a portable lighting plant. If you are faced with bulk cement specifications—or interested in bulk cement savings—use the coupon.

Bucket Loaders
Coal Loaders
Snow Loaders
Trailers
Loaders with Weighing and Batching Hoppers
Loaders with Vibrating and Grizzly Screens
Coal and Coke Car Unloaders
Permanent Belt Conveyors
Portable Flight Conveyors
Standard Gas and Water Ditchers
Pipe Line Special Ditchers
Belt Car Unloaders
Portable Belt Conveyors
Self-Propelled Flight Conveyors
Utility Special Ditchers
Service Special Ditchers

BARBER-GREENE CO., 530 W. Park Ave, Aurora, Ill.

Please send me complete information on the new B-G Cement Loader.

*Name*_____

*Address*_____

*City*_____ *State*_____

One of the Tennessee test sections where Calcium Chloride and other special curing methods were used alongside Standard Wet Earth curing on the same pavement for comparison.

The TENNESSEE INVESTIGATION

THE TENNESSEE DEPARTMENT OF HIGHWAYS and the U. S. Bureau of Public Roads laid 15 miles of concrete pavement in Tennessee in which one-half (longitudinally) was cured by Standard Wet Earth curing and the other half by special curing processes.

The average taken from the eight sections cured by Calcium Chloride surface applications showed that (1) Hardness of surface and (2) Average length of uncracked slab were practically equal to Standard Wet Earth cure; (3) Average core strength rating was somewhat better than standard.

These tests show that Calcium Chloride surface curing is an entirely satisfactory method. It insures full strength concrete; does not cause volume changes that cause checking or cracking; and produces a hard wearing surface.

Again it was demonstrated that a simple application of Calcium Chloride accomplishes as much as a Standard Wet Earth cure and does not require the attention necessary for placing of earth and 10 days of sprinkling beside the special inspection of engineers. Send the coupon for complete data.

Calcium Chloride Publicity Committee

Send this coupon to any one of these companies

The Dow Chemical Company, Midland, Michigan
Solvay Sales Corporation, 61 Broadway, N. Y. City
The Columbia Alkali Company, Barberton, Ohio

Please send complete data on Calcium Chloride concrete curing practice.

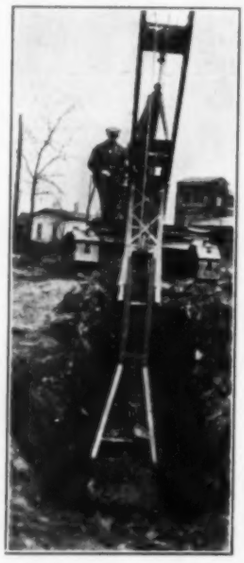
Name _____

Position _____

Address _____

CM 5-31

FUNDOM SHOVELS
Make Profitable
Small and Average Size Jobs



A UNIQUE three-in-one design, unusual speed, low cost, big yardage and adaptability make the Fundom a profitable buy for average size and small jobs.

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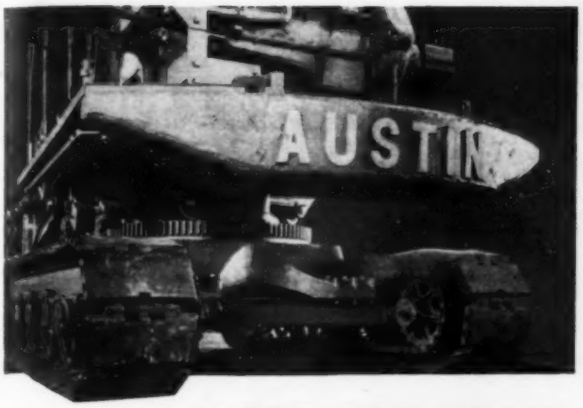

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JAEGER
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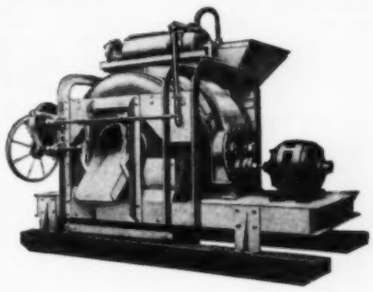

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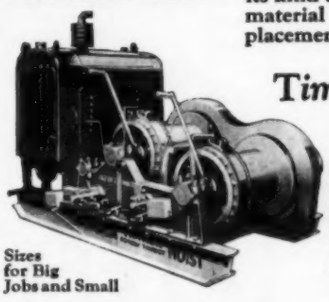

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LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of Construction Methods, published monthly at New York, N. Y., for April 1, 1931.
State of New York } ss
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared C. H. Thompson, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Construction Methods, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 10th Ave. & 36th St., N. Y. C. Editor, Robert K. Tomlin, 10th Ave. & 36th St., N. Y. C. Managing Editor, None. Business Manager, Willard T. Chevalier, 10th Ave. & 36th St., N. Y. C.

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5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only.)

C. H. THOMPSON, Secretary

McGRAW-HILL PUBLISHING COMPANY, INC.
Sworn to and subscribed before me this 31st day of March, 1931.
[SEAL] H. E. BEIRNE.

Notary Public N. Y. Co. Clk's No. 203, Reg. No. 3B102. Kings Co. Clk's No. 636, Reg. No. 3129. (My Commission expires March 30, 1933)

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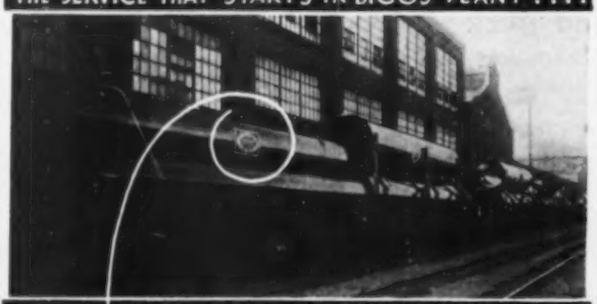

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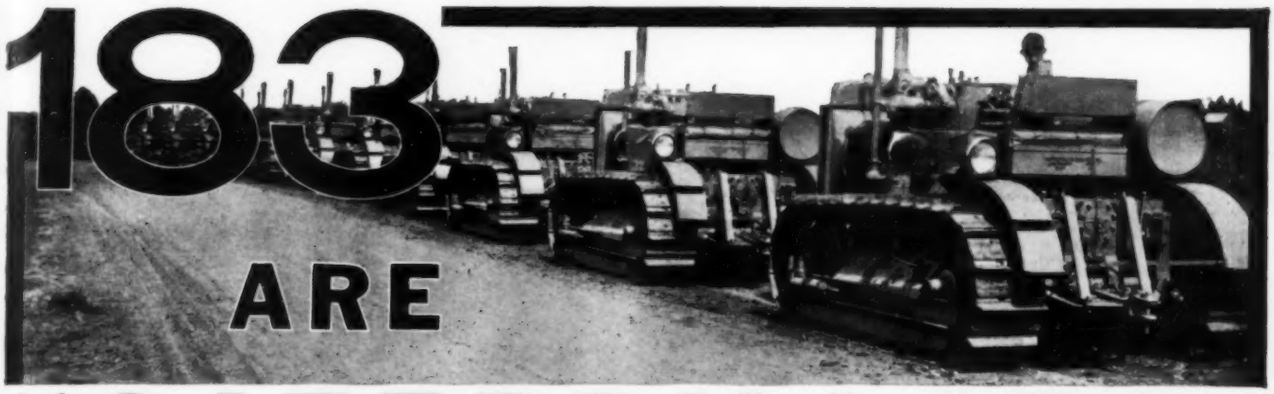

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